US011708048B2

(12) **United States Patent**
Ozeki et al.

(10) **Patent No.: US 11,708,048 B2**
(45) **Date of Patent: Jul. 25, 2023**

(54) **PEDESTRIAN AIRBAG DEVICE**

(71) Applicant: **TOYODA GOSEI CO., LTD.**, Kiyosu (JP)

(72) Inventors: **Makoto Ozeki**, Kiyosu (JP); **Akira Yasuda**, Kiyosu (JP); **Taizo Suemitsu**, Kiyosu (JP)

(73) Assignee: **TOYODA GOSEI CO., LTD.**, Aichi-pref. (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/576,309**

(22) Filed: **Jan. 14, 2022**

(65) **Prior Publication Data**

US 2022/0250578 A1 Aug. 11, 2022

(30) **Foreign Application Priority Data**

Feb. 8, 2021 (JP) 2021-18589

(51) **Int. Cl.**
B60R 21/36 (2011.01)
B60R 21/34 (2011.01)

(52) **U.S. Cl.**
CPC ***B60R 21/36*** (2013.01)

(58) **Field of Classification Search**
CPC B60R 21/34; B60R 21/36
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

10,807,561 B2 * 10/2020 Ozeki B60R 21/36
11,485,314 B2 * 11/2022 Ozeki B60R 21/36
2008/0308338 A1 * 12/2008 Kitte B60R 21/38 180/271
2009/0102167 A1 * 4/2009 Kitte B60R 21/2338 280/743.2
2014/0015234 A1 * 1/2014 Nukaya B60R 21/231 280/730.1
2019/0039560 A1 * 2/2019 Ozeki B60R 21/36
2019/0299918 A1 10/2019 Ozeki et al.
2019/0299920 A1 * 10/2019 Ozeki B60R 21/201
2022/0153224 A1 * 5/2022 Ozeki B60R 21/201
2022/0250579 A1 * 8/2022 Ozeki B60R 21/23138
2022/0371542 A1 * 11/2022 Ozeki B60R 21/36
(Continued)

FOREIGN PATENT DOCUMENTS

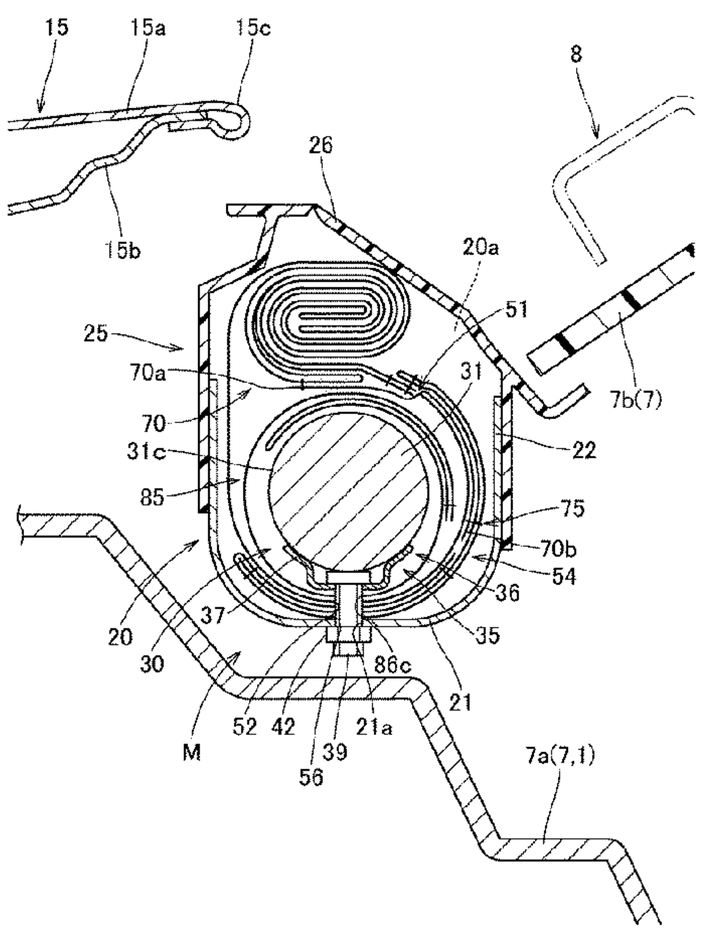
DE 102008011468 A1 * 9/2008 ..... B60R 21/36
DE 102013202731 A1 * 8/2014 ..... B60R 21/36
JP H10-119702 A 5/1998
(Continued)

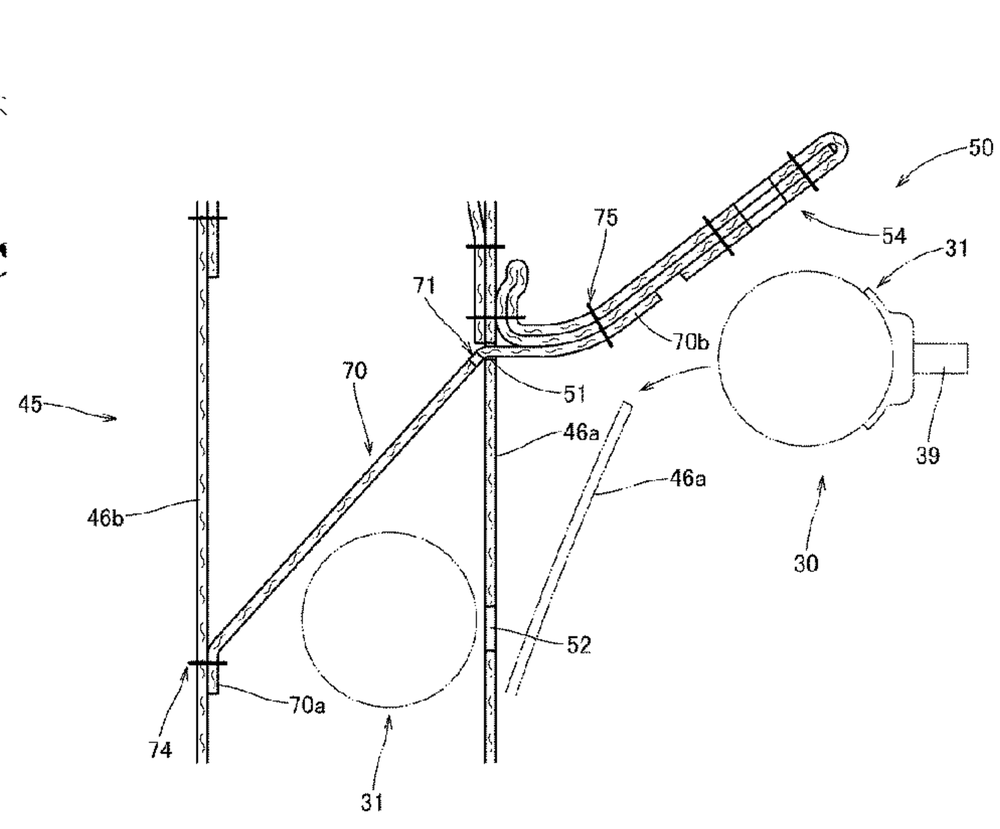
Primary Examiner — Barry Gooden, Jr.
(74) *Attorney, Agent, or Firm* — Posz Law Group, PLC

(57) **ABSTRACT**

A pedestrian airbag device includes an airbag and an inflator that supplies an inflating gas to the airbag. In the airbag, an insertion opening portion for inserting the inflator into the airbag is disposed on the vehicle body side wall portion side. The insertion opening portion includes an insertion slit for inserting the main body portion of the inflator, and an insertion hole for causing the mounting bolt of the inflator to protrude. A guide tether for guiding when the inflator is inserted is disposed inside the airbag so that one end side is joined to the pedestrian side wall portion side, and the other end side is joined to a region on a side from the insertion hole in a peripheral edge of the insertion slit on the vehicle body side wall portion side.

4 Claims, 17 Drawing Sheets





(56) **References Cited**

U.S. PATENT DOCUMENTS

2022/0396232 A1* 12/2022 Ozeki B60R 21/36

FOREIGN PATENT DOCUMENTS

JP	2006-044612	A		2/2006	
JP	2019026223	A	*	2/2019	
JP	2019-172170	A		10/2019	
JP	2020-050269	A		4/2020	
JP	2020100377	A	*	7/2020	..... H04N 1/52

* cited by examiner

FIG. 1

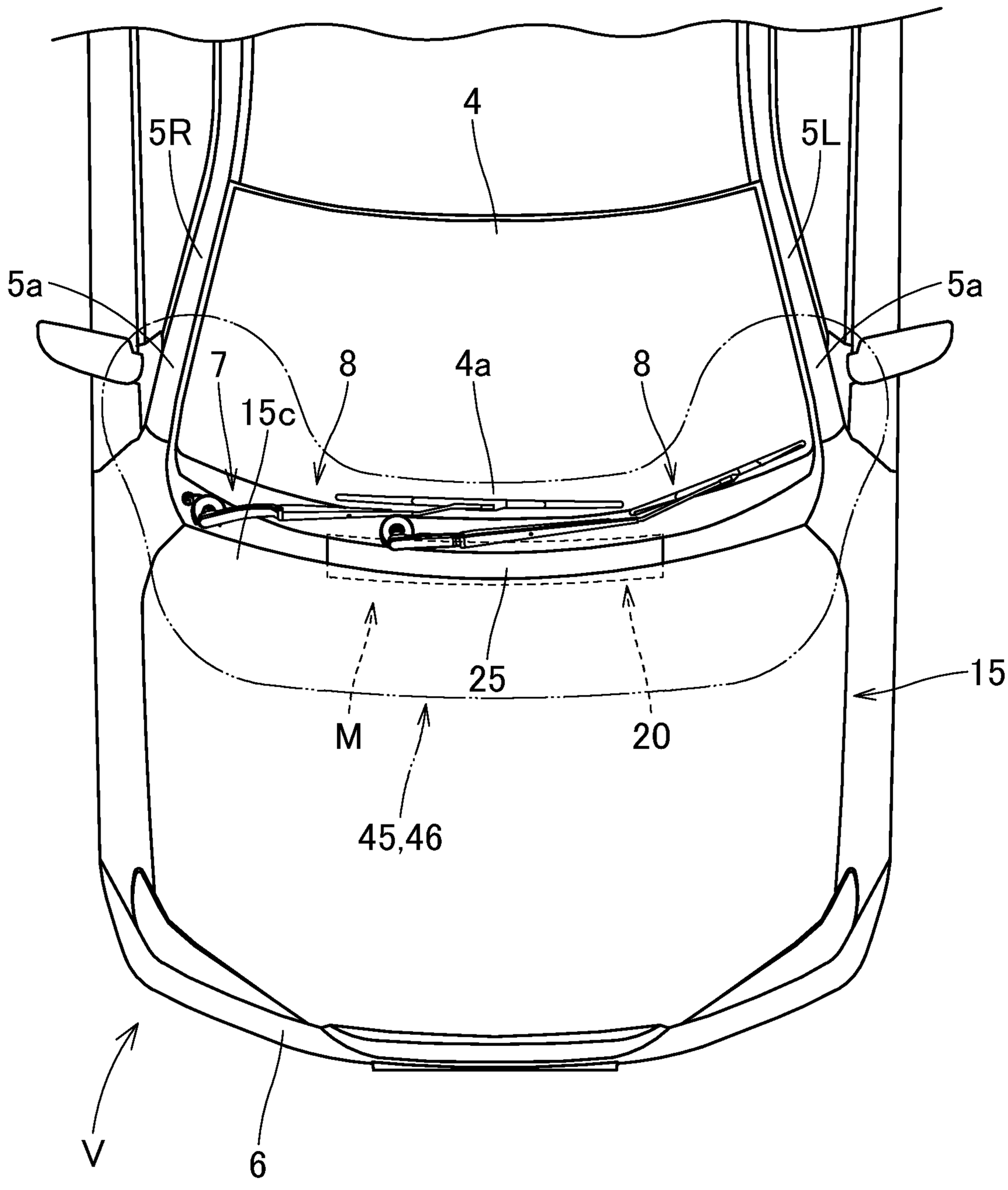


FIG. 2

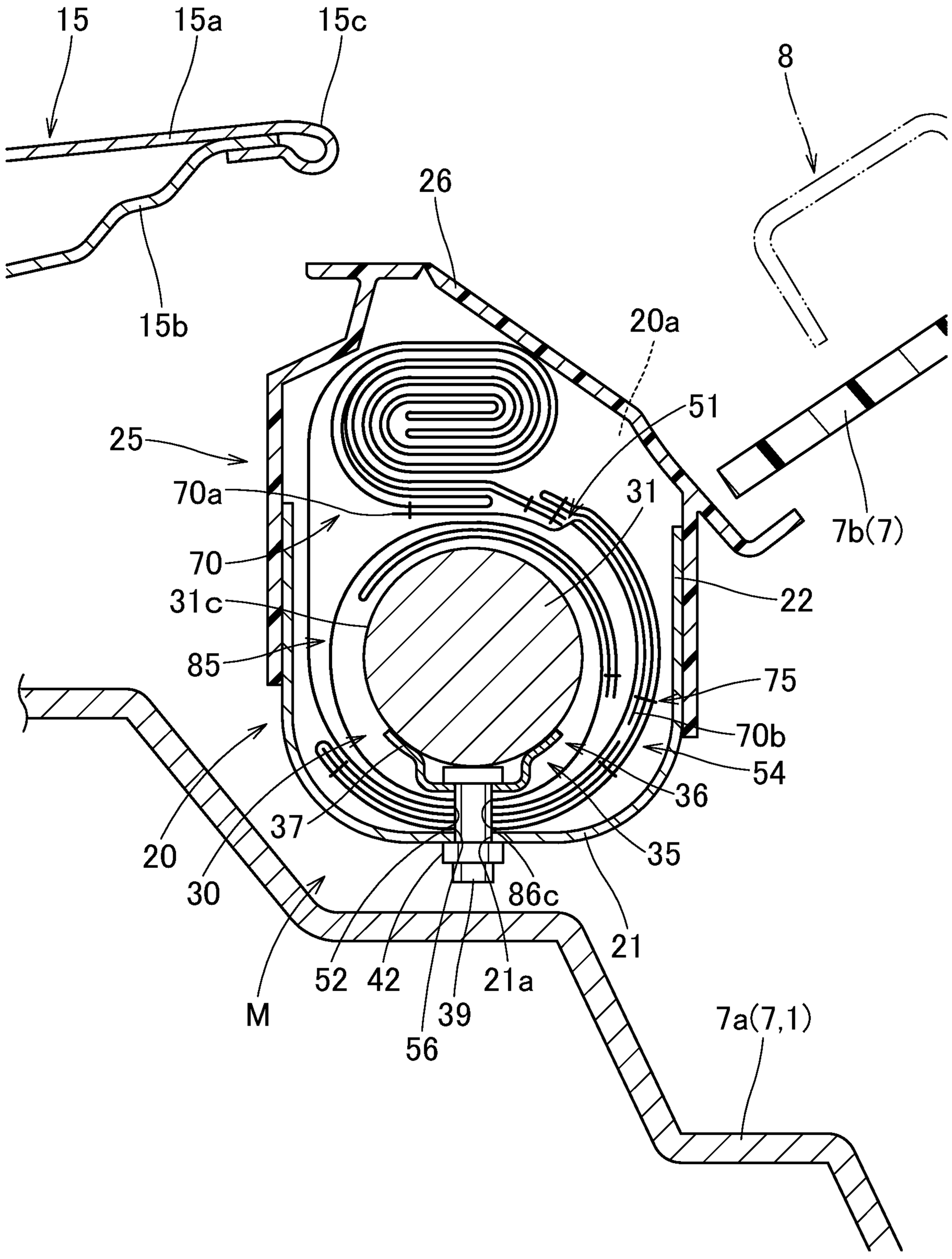

15
15a
15c
15b
26
8
20a
51
25
70a
31
7b(7)
70
22
31c
85
75
70b
54
36
37
35
20
30
86c
21
52
42
21a
39
M
56
7a(7,1)

FIG. 3

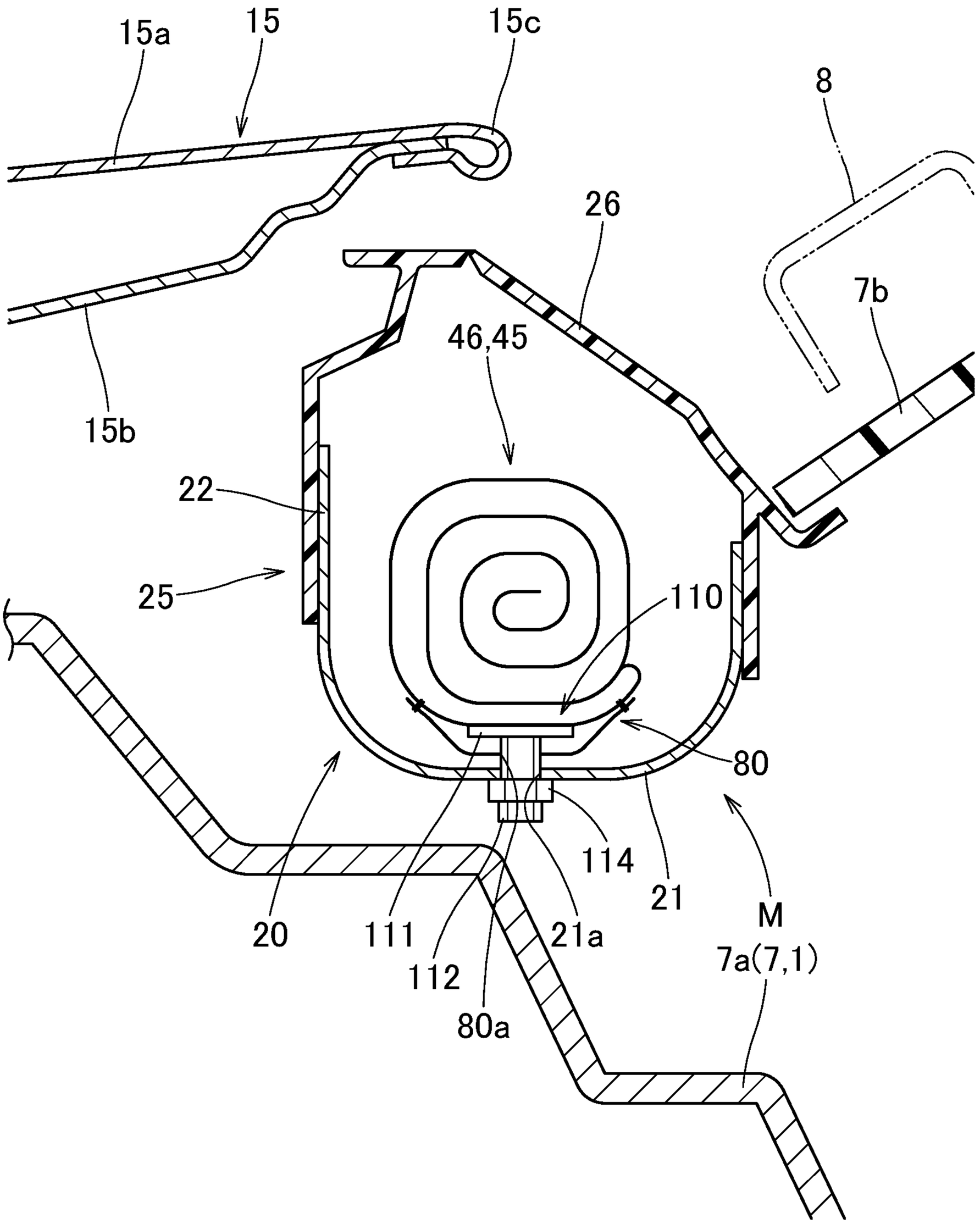

15a
15
15c
8
26
7b
46,45
15b
22
25
110
80
114
21
M
20
111
112
21a
80a
7a(7,1)

FIG. 4

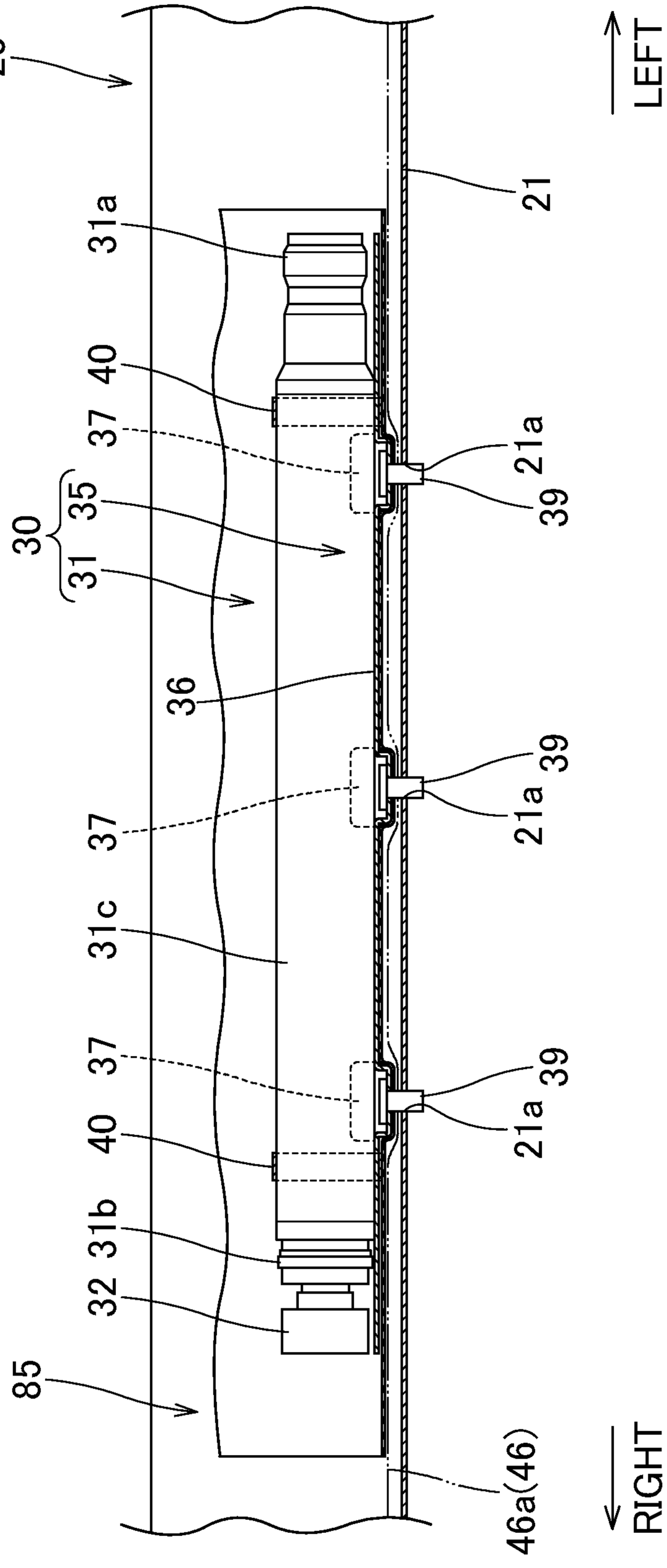

20
LEFT
21
31a
40
37
21a
39
30
35
31
36
37
39
21a
31c
37
39
21a
40
31b
32
85
46a(46)
RIGHT

FIG. 5

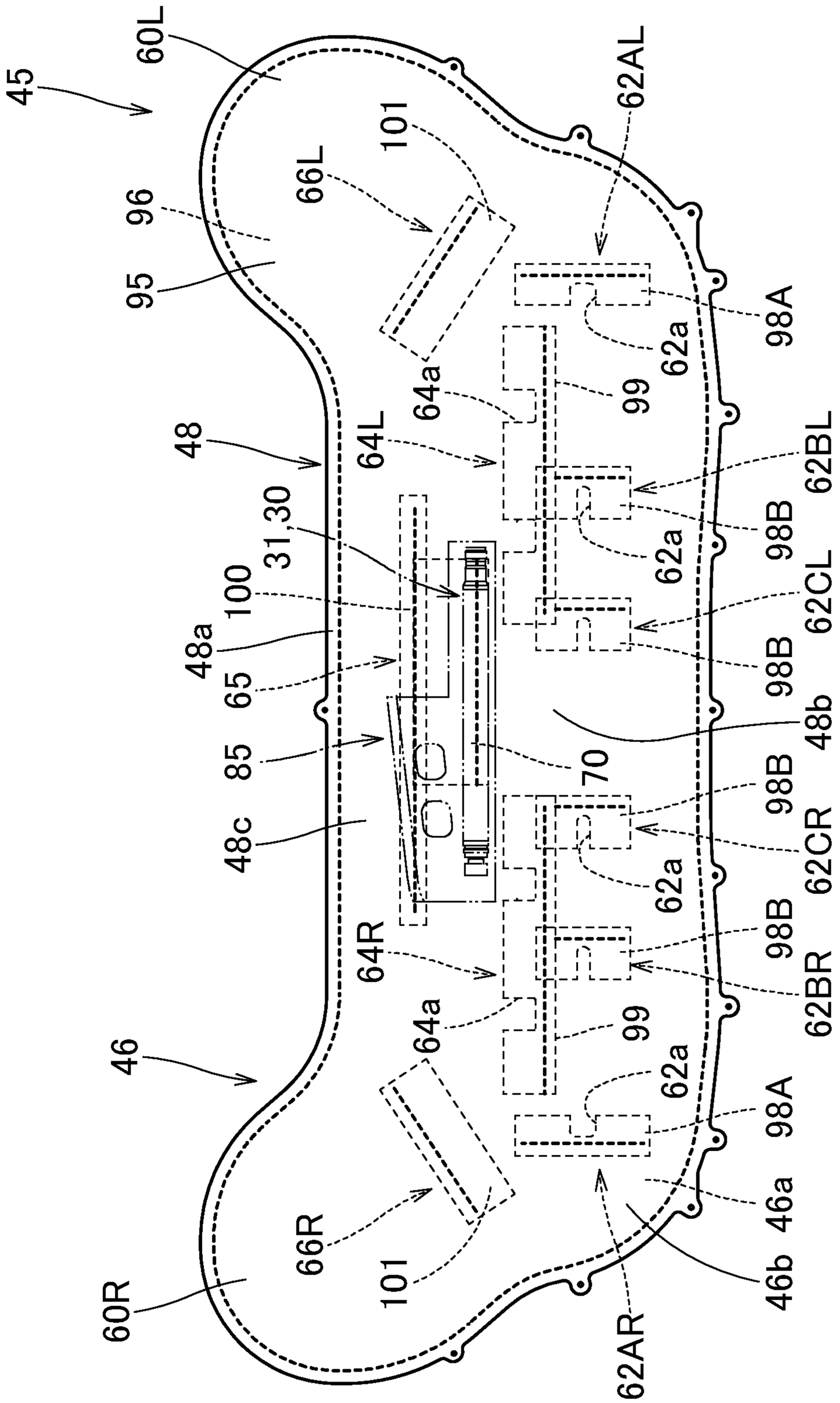

45
60L
62AL
101
66L
96
95
48
64L
64a
99
62a
98A
62BL
98B
31,30
100
48a
65
62CL
85
48c
70
48b
62CR
64R
62BR
46
66R
60R
62AR
46a
46b

FIG. 6

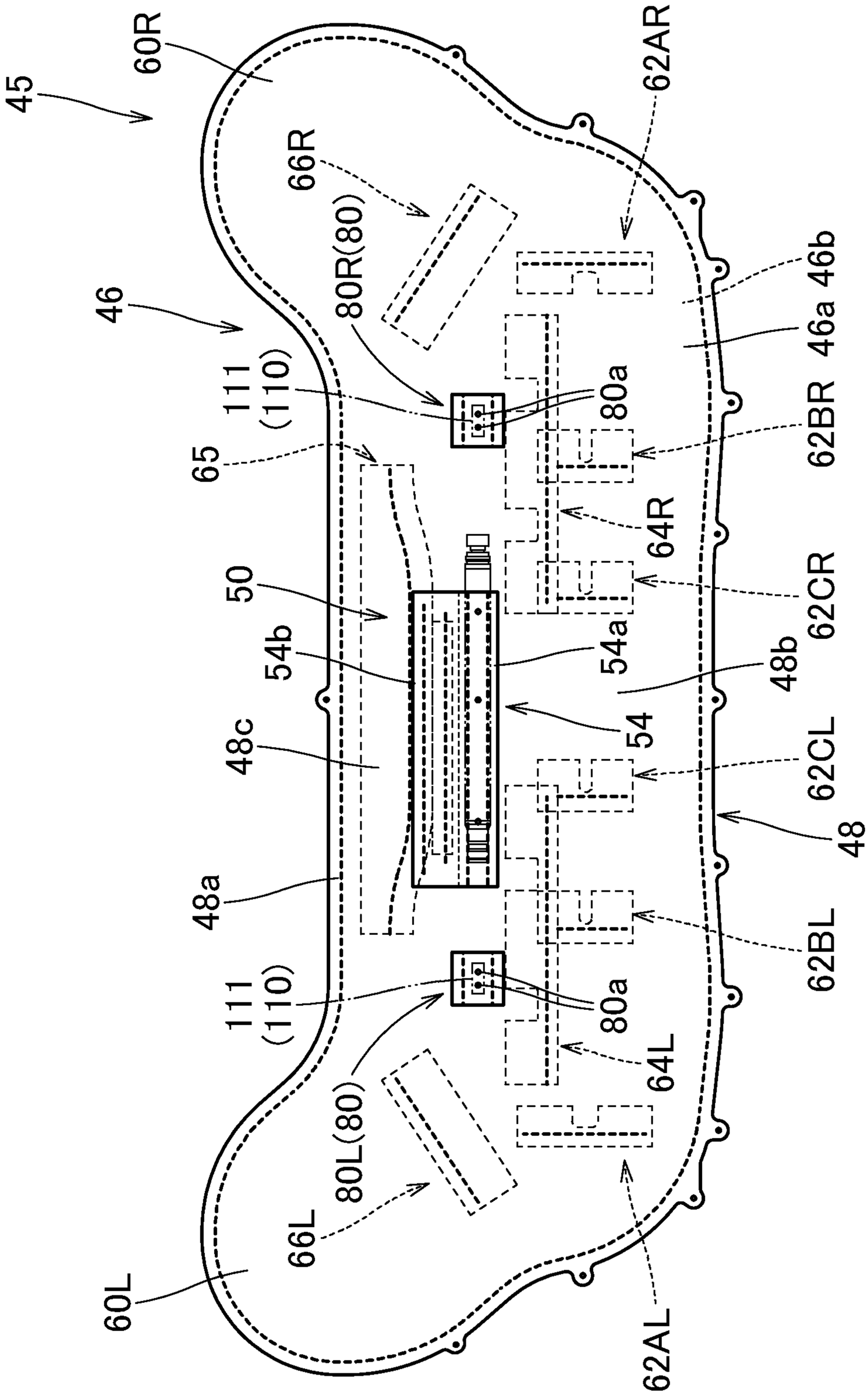

45
60R
62AR
66R
80R(80)
46
46a 46b
111
(110)
65
80a
62BR
64R
50
62CR
54b
54a
48b
54
48c
62CL
48
48a
62BL
111
(110)
80a
64L
80L(80)
66L
60L
62AL

FIG. 7

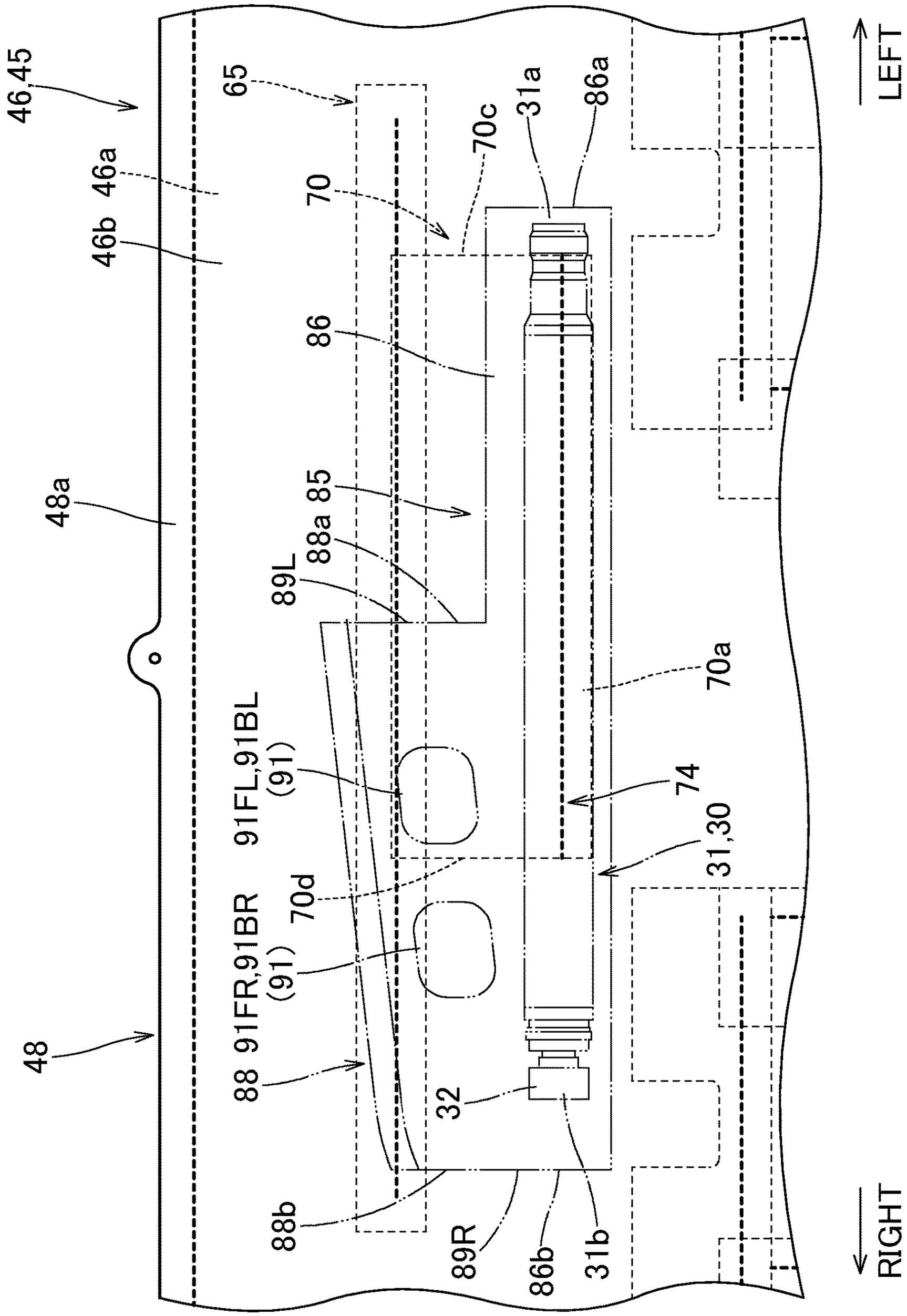

46
45
65
70c
31a
86a
LEFT
46a
70
46b
86
48a
88a
85
89L
91FL,91BL
(91)
70a
74
70d
31,30
91FR,91BR
(91)
48
88
32
88b
89R
86b
31b
RIGHT

FIG. 8

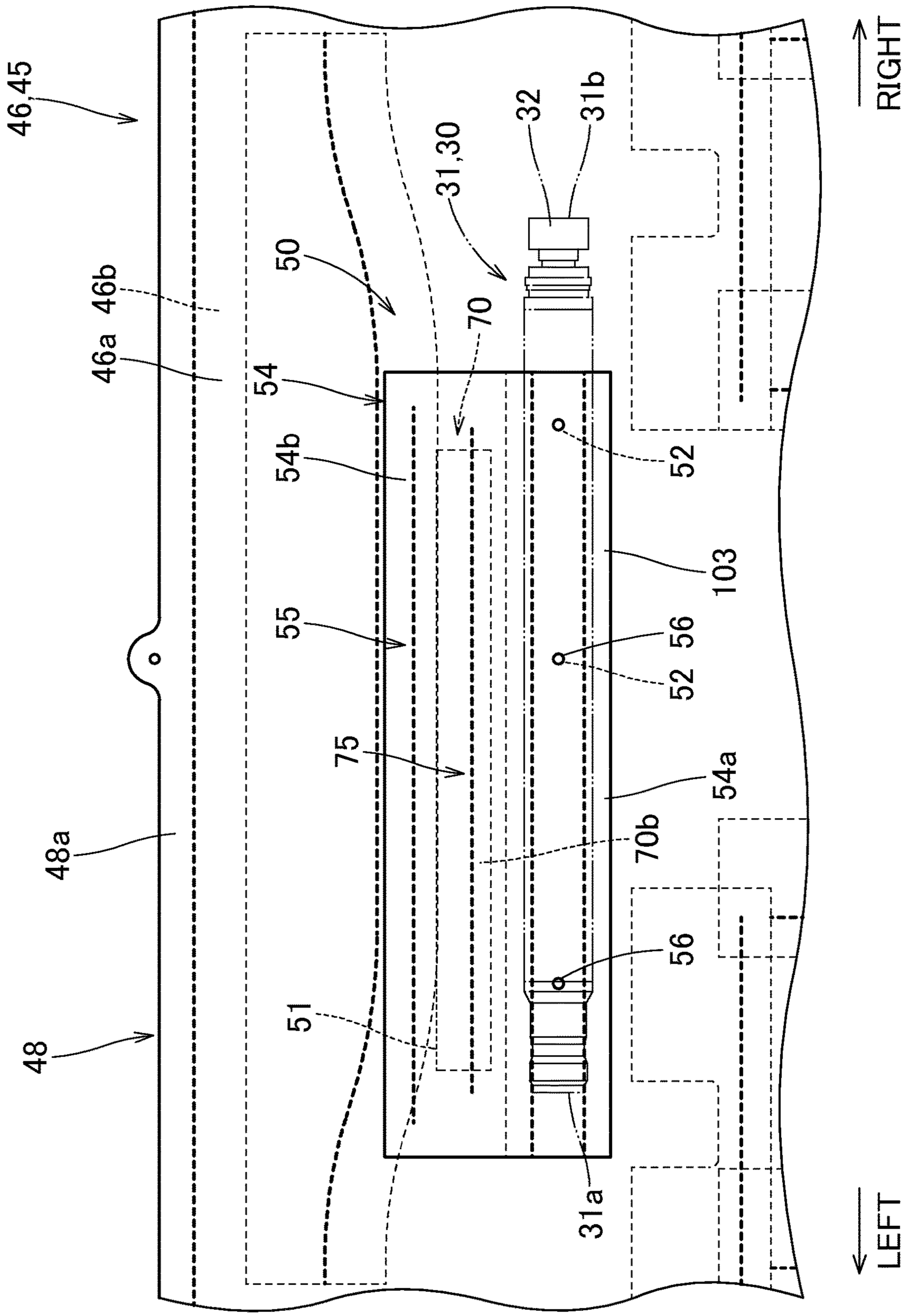

46,45
46b
46a
48a
48
50
54
54b
55
75
51
31,30
32
31b
70
52
103
56
52
54a
70b
56
31a
RIGHT
LEFT

FIG. 9

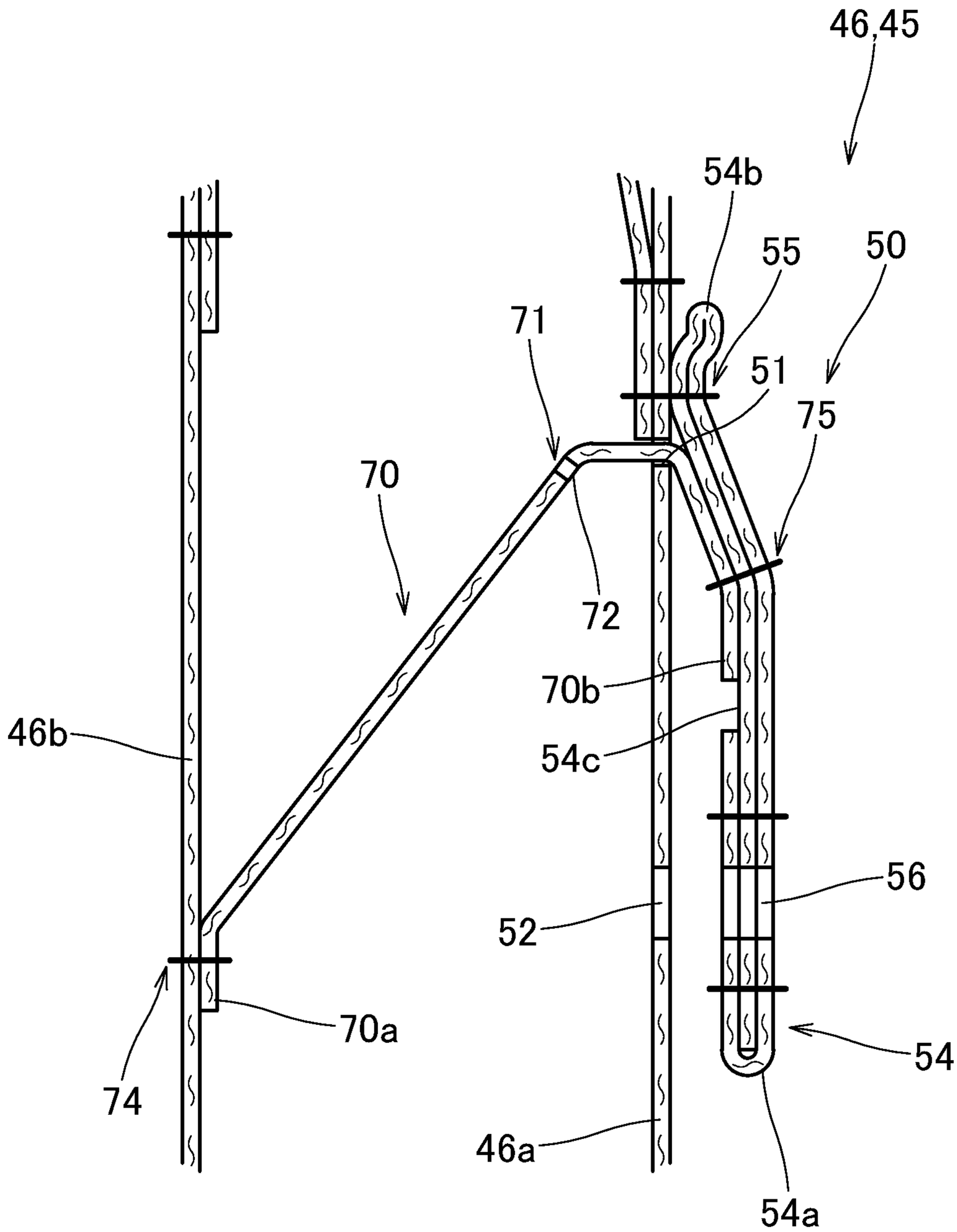


FIG. 10

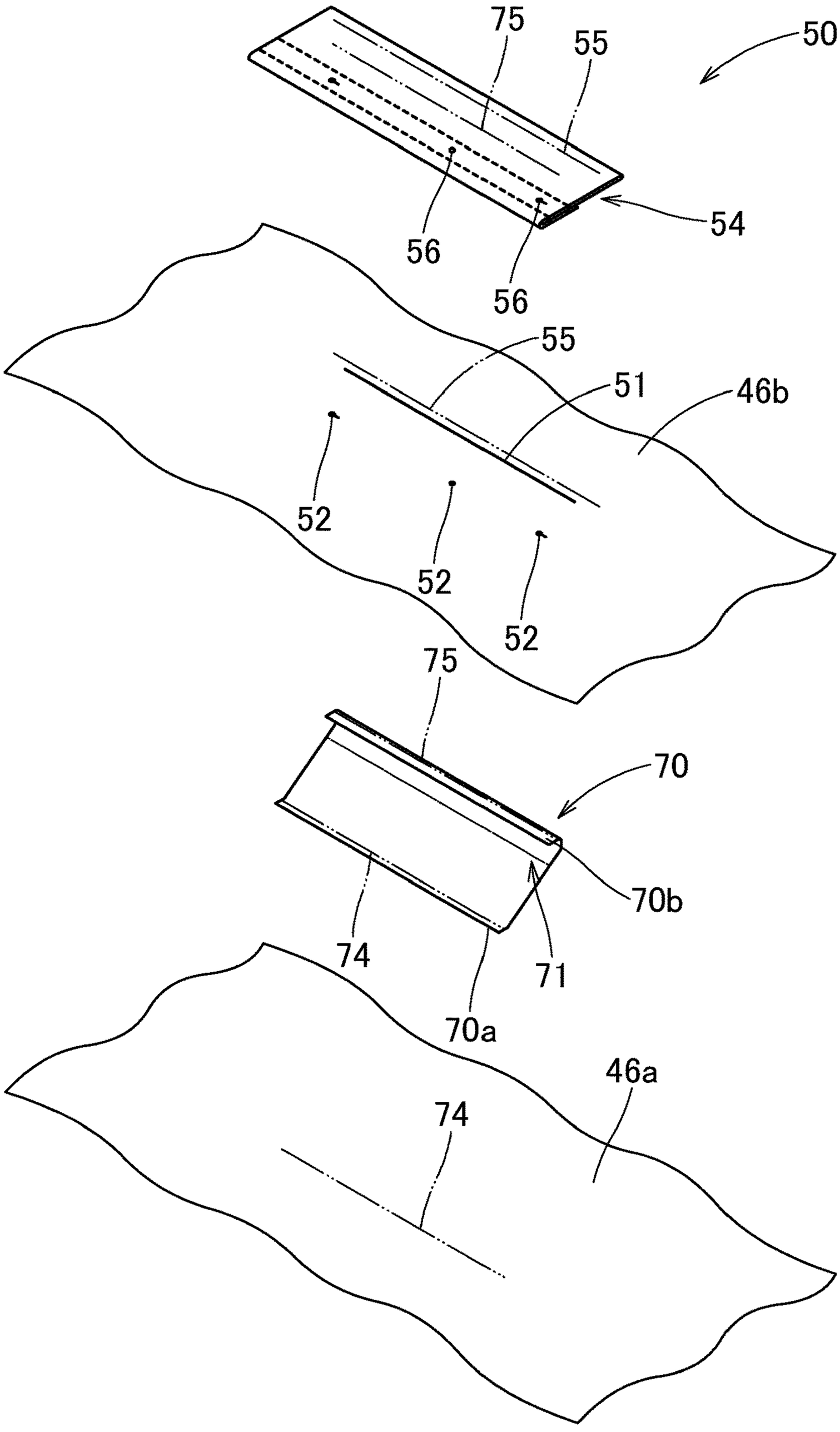
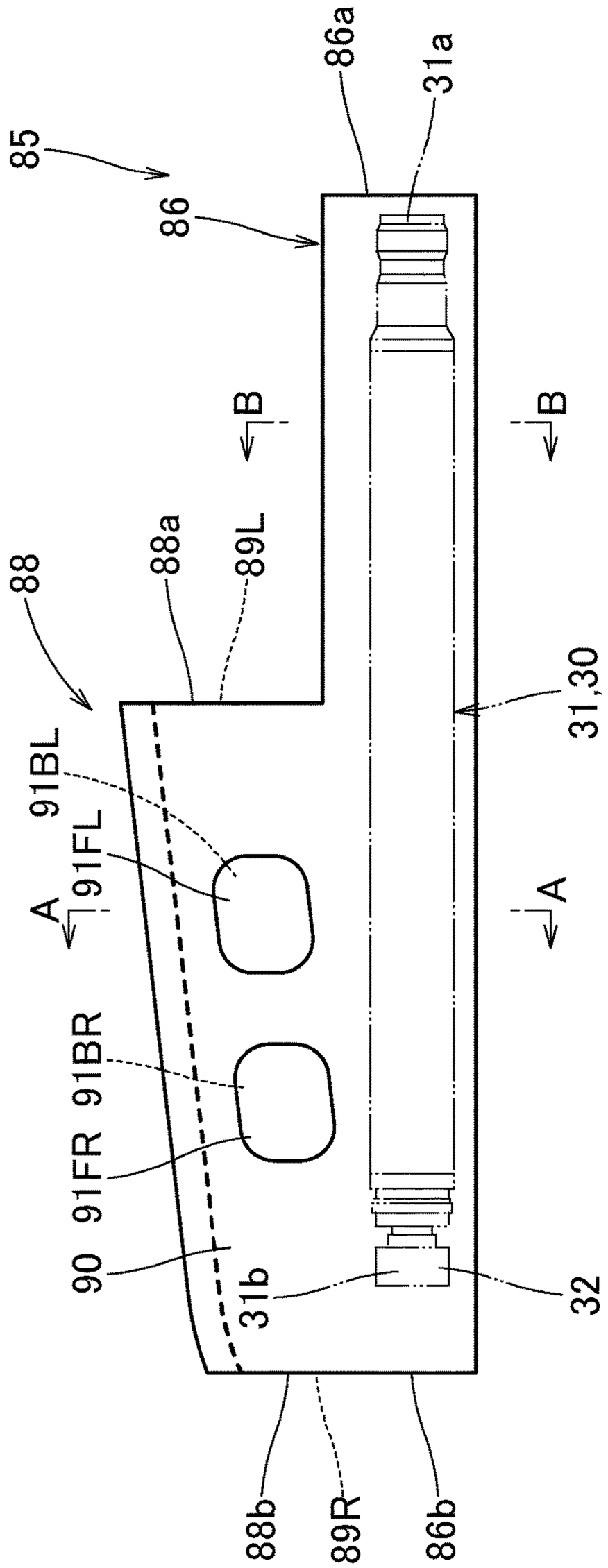


FIG. 11


85
86
86a
31a
88
88a
89L
91BL
91FL
91FR
91BR
90
31b
32
88b
89R
86b
A
B
31,30

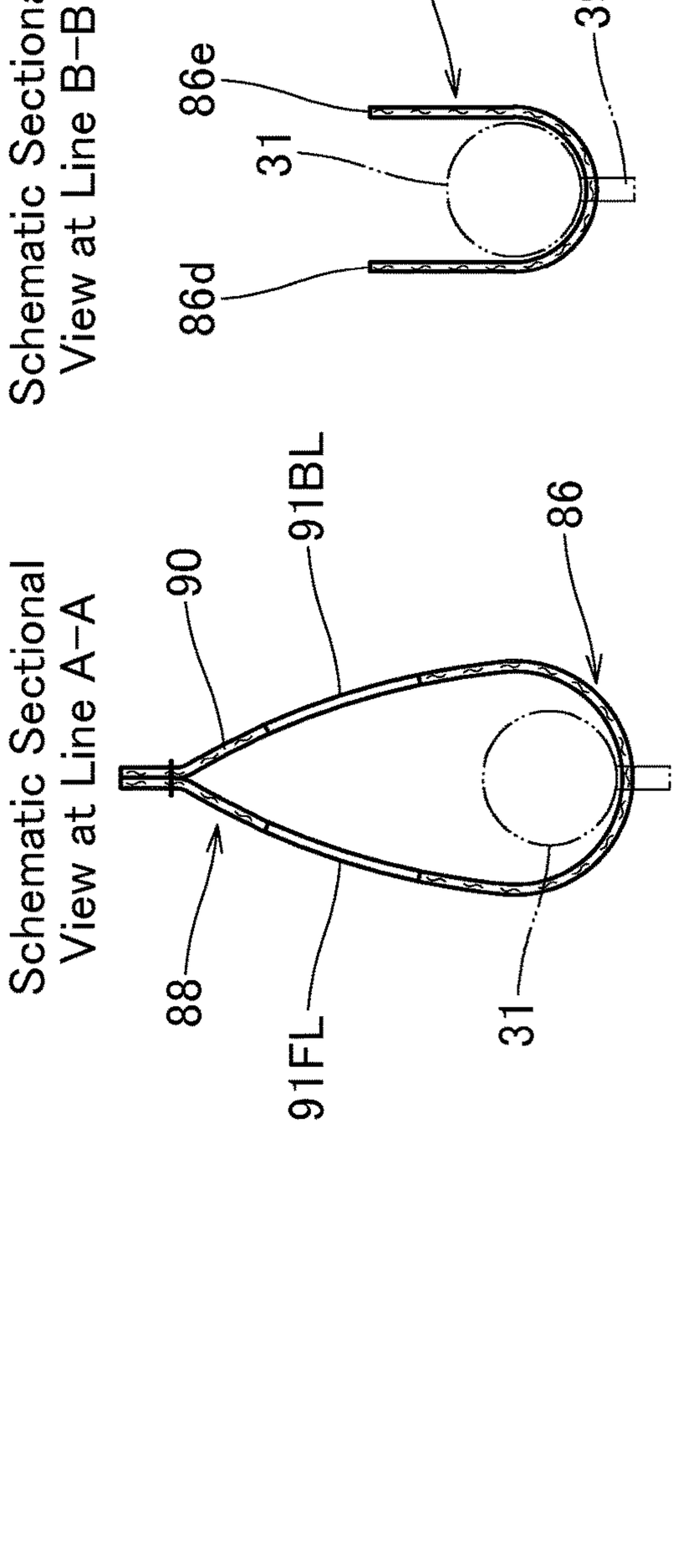

Schematic Sectional View at Line B–B
86
86e
31
86d
39
Schematic Sectional View at Line A–A
90
91BL
86
88
91FL
31

FIG. 12

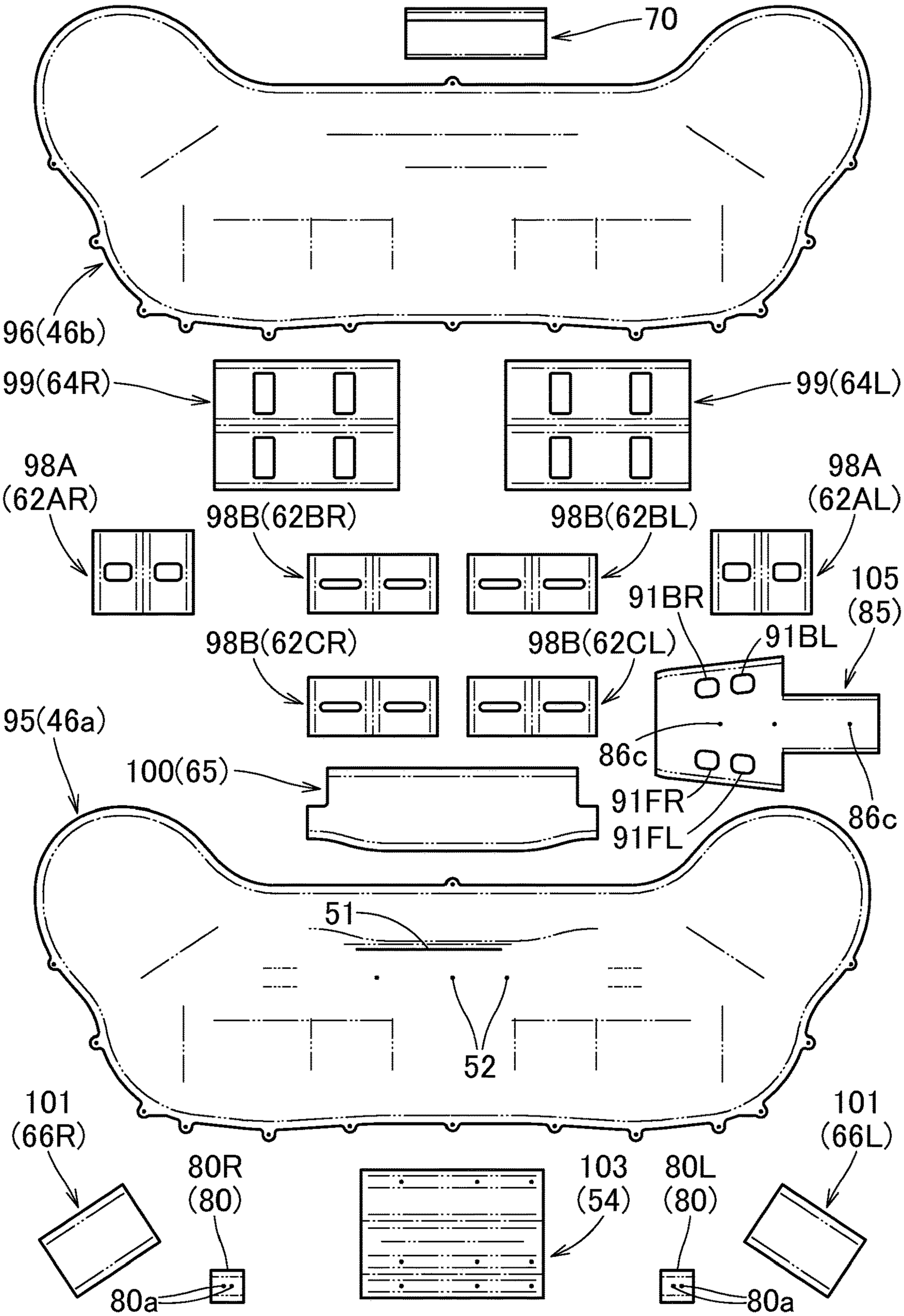

70
96(46b)
99(64R)
99(64L)
98A
(62AR)
98B(62BR)
98B(62BL)
98A
(62AL)
105
(85)
91BR
91BL
98B(62CR)
98B(62CL)
95(46a)
100(65)
86c
91FR
91FL
86c
51
52
101
(66R)
80R
(80)
103
(54)
80L
(80)
101
(66L)
80a
80a

FIG. 13

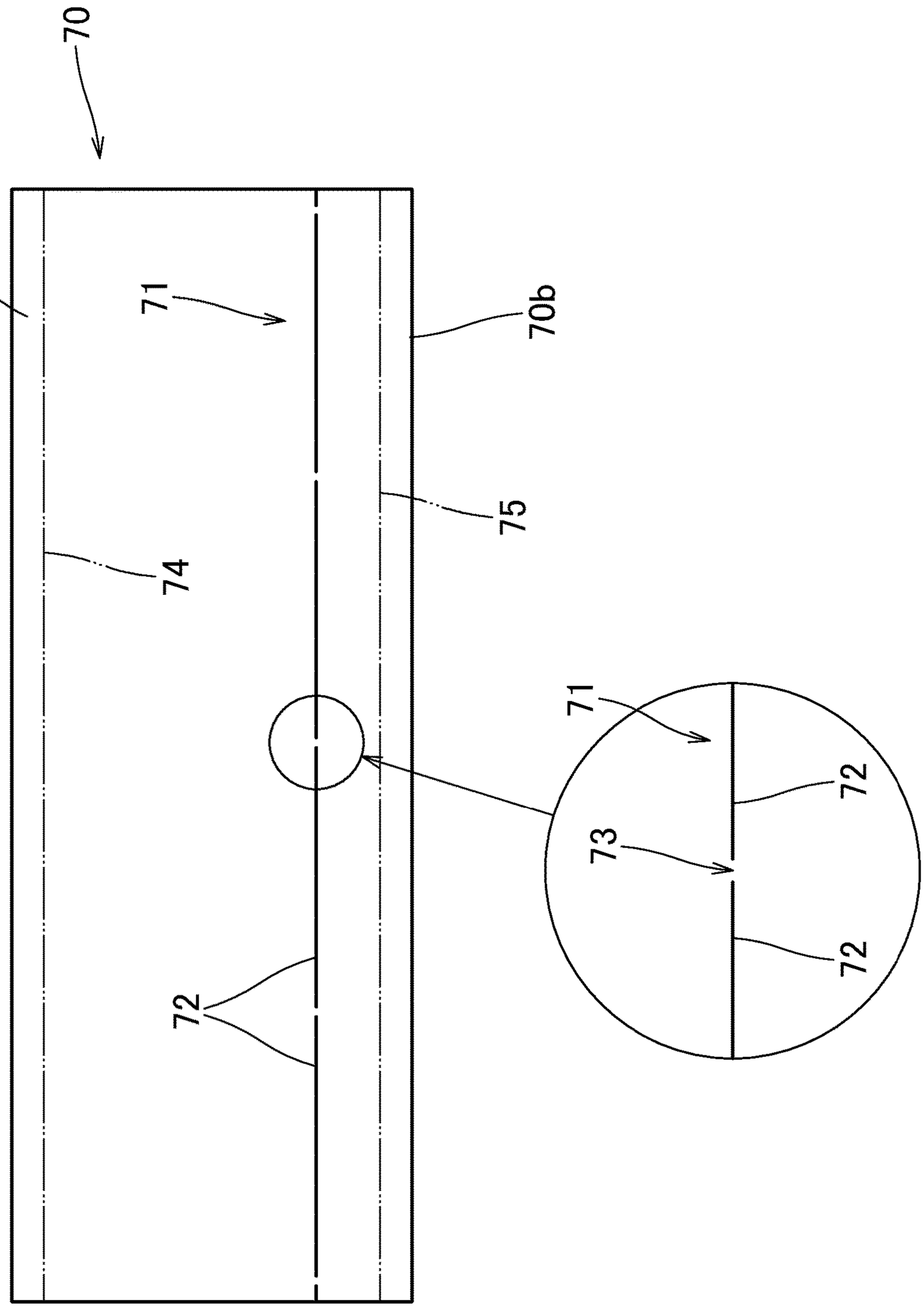


FIG. 14

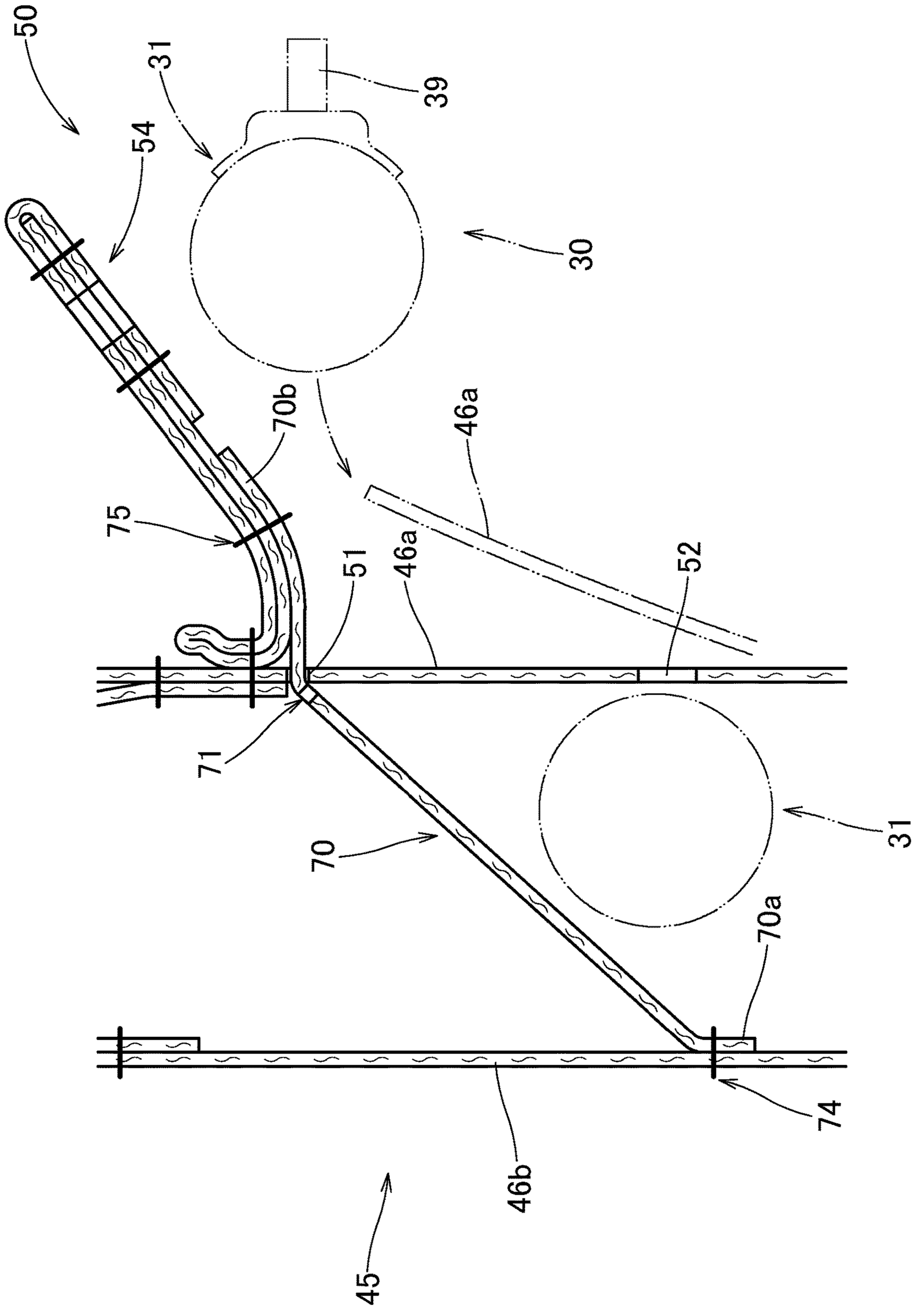


FIG. 15A

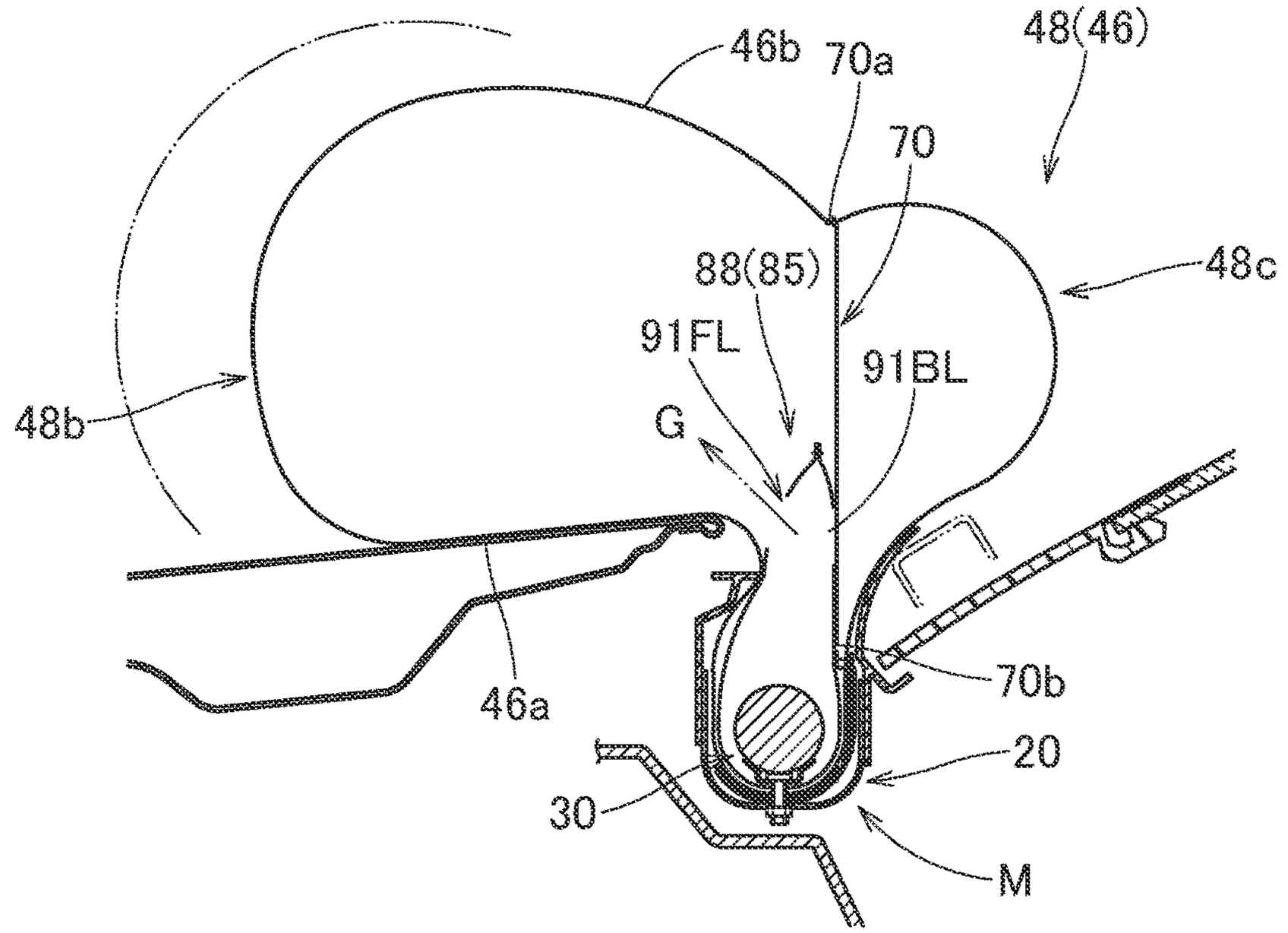


FIG. 15B

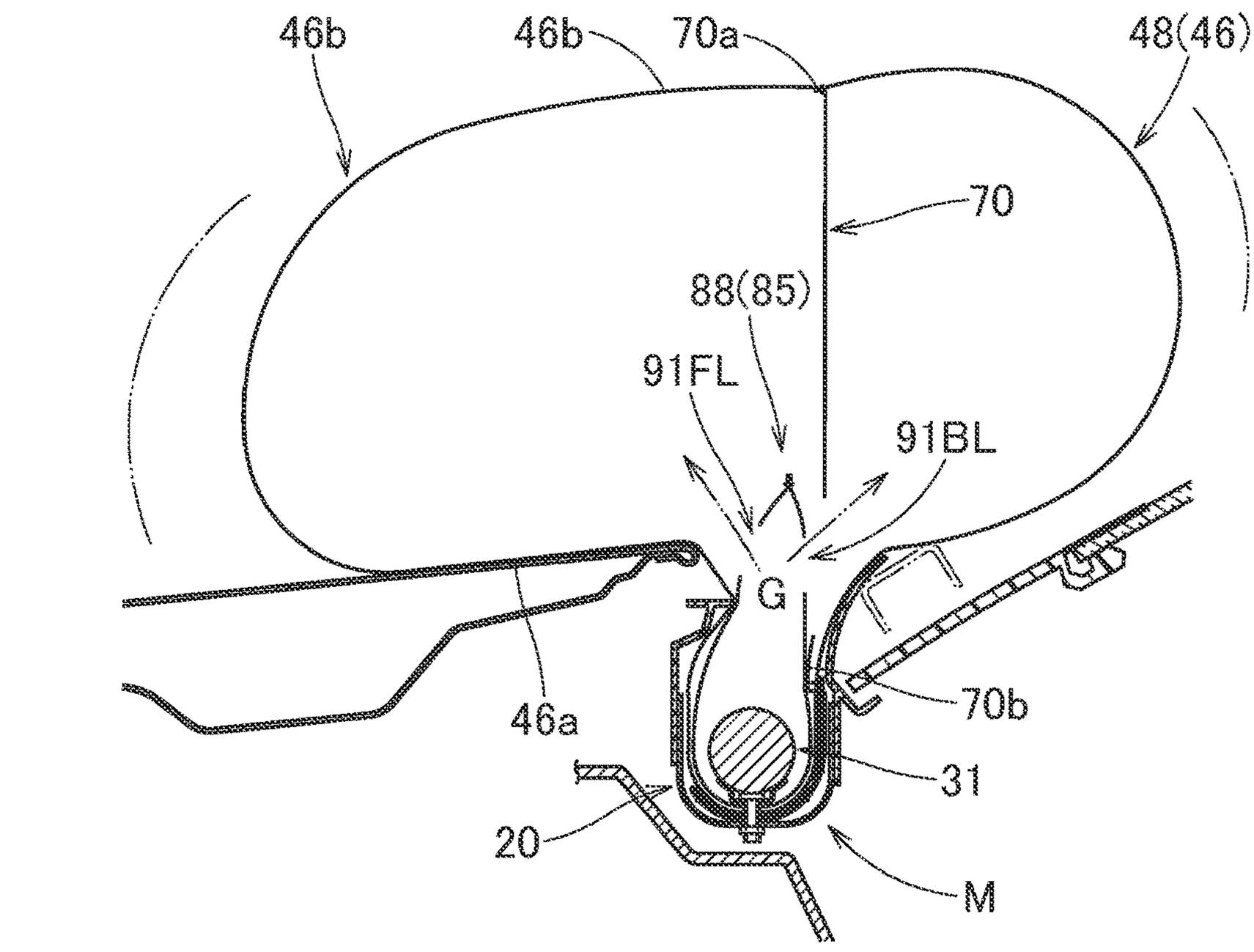


FIG. 16

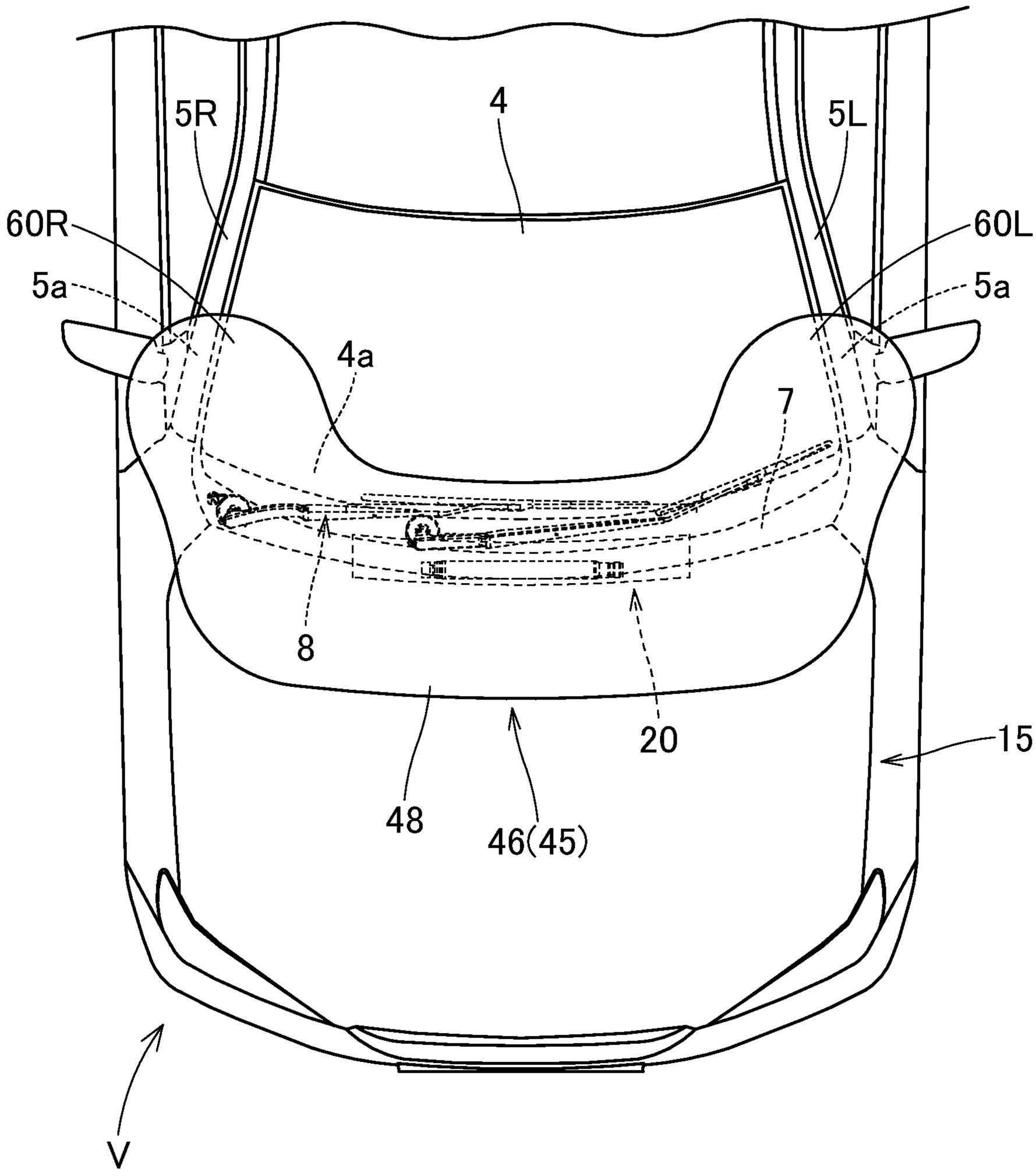
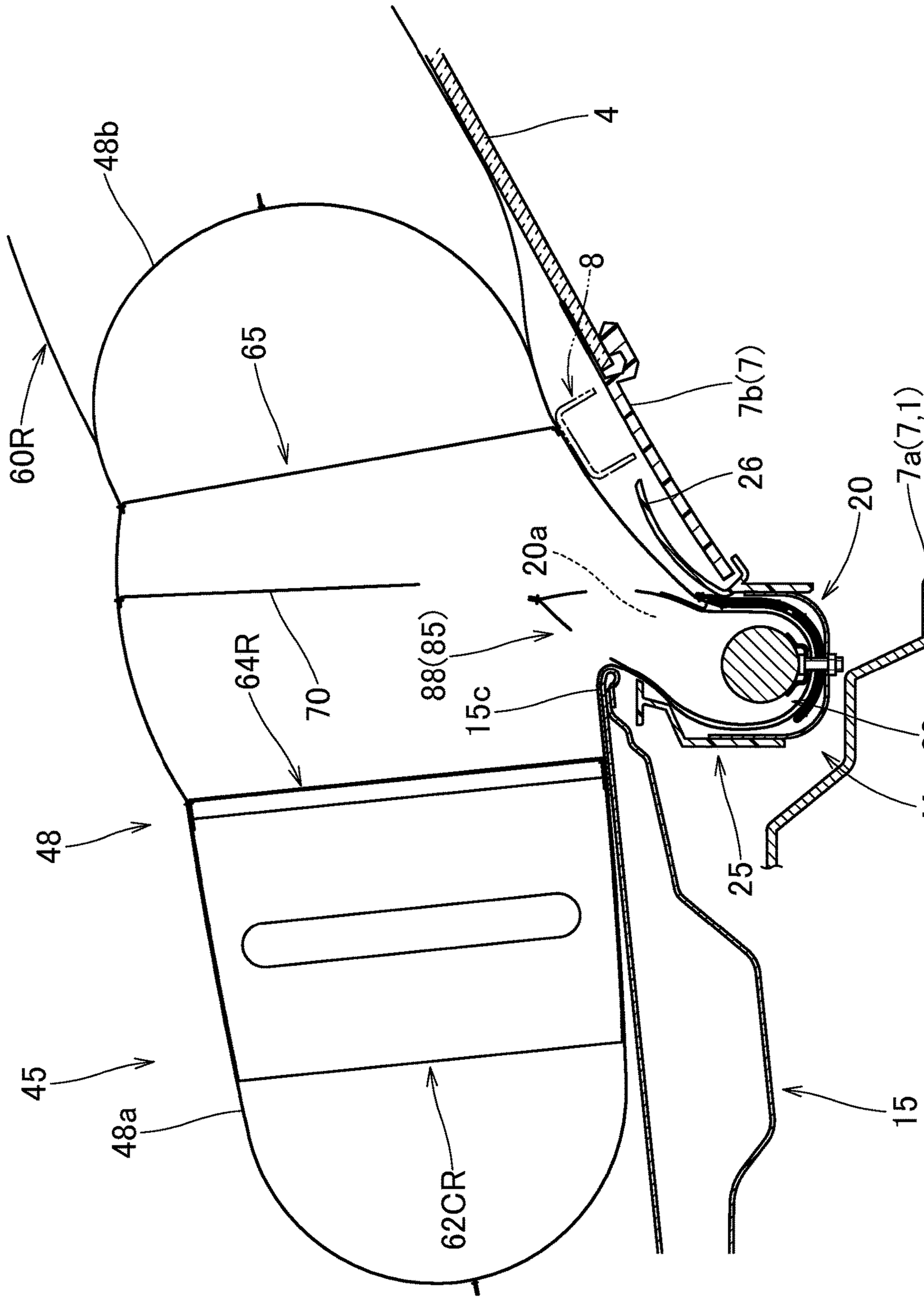


FIG. 17


48b
4
8
60R
65
7b(7)
26
20
7a(7,1)
20a
64R
70
88(85)
15c
30
48
M
25
45
48a
62CR
15

PEDESTRIAN AIRBAG DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

The present application claims priority from Japanese Patent Application No. 2021-18589 of Ozeki et al., filed on Feb. 8, 2021, the entire disclosure of which is incorporated herein by reference.

BACKGROUND

1. Technical Field

The present disclosure relates to a pedestrian airbag device including an airbag folded and accommodated inside an accommodation site disposed near a rear end of a hood panel of a vehicle, and an inflator that supplies an inflating gas to the airbag, and configured to inflate the airbag to cover an upper surface on a rear end side of the hood panel.

2. Description of Related Art

In the related art, as the pedestrian airbag device, as disclosed in JP-A-2019-172170, there is a configuration as follows. In a state where an inflator causing a mounting bolt to protrude from an outer peripheral surface of a columnar main body portion is inserted into an airbag, the mounting bolt protruding outward of the airbag is fixed to an accommodation site side so that the inflator and the airbag are mounted on the accommodation site side. In the pedestrian airbag device, the main body portion of the inflator is inserted into the airbag by using an insertion slit formed in the airbag, and the mounting bolt protrudes from an insertion hole.

Normally, in the pedestrian airbag device having this configuration, the inflator is in a state of a completely folded body so that the airbag can be accommodated inside the accommodation site. In this state, the inflator is accommodated inside the airbag by inserting the main body portion into the airbag through the insertion slit. Therefore, there is room for improvement in that satisfactory assembly workability needs to be achieved by easily preventing occurrence of erroneous insertion when the inflator is inserted into the completely folded body in which a vehicle body side wall portion and a pedestrian side wall portion are folded multiple times.

SUMMARY

The present disclosure relates to a pedestrian airbag device having the following configuration.

The pedestrian airbag device includes an airbag folded and accommodated inside an accommodation site disposed near a rear end of a hood panel of a vehicle, and an inflator that supplies an inflating gas to the airbag, in which the airbag is inflated to cover an upper surface on the rear end side of the hood panel, the inflator includes a main body portion having a substantially columnar outer shape, and a mounting bolt disposed to protrude from an outer peripheral surface of the main body portion in an axis orthogonal direction of the main body portion, the main body portion is mounted on the accommodation site by using the mounting bolt in a state where the main body portion is inserted into the airbag so that the mounting bolt protrudes outward, the airbag has a vehicle body side wall portion disposed on a body side when inflation is completed, and a pedestrian side wall portion disposed to face the vehicle body side wall portion, in which peripheral edges of the vehicle body side wall portion and the pedestrian side wall portion are joined to each other to form a bag shape. An insertion opening portion for inserting the inflator into the airbag is provided on the vehicle body side wall portion side, the insertion opening portion includes an insertion slit formed in the vehicle body side wall portion, substantially extending along an axial direction of the main body portion, and used for inserting the main body portion, and an insertion hole disposed at a position separated from the insertion slit on a side in a substantially orthogonal direction, and used for causing the mounting bolt to protrude, and a guide tether for guiding when the inflator is inserted is disposed inside the airbag so that one end side is joined to the pedestrian side wall portion, and the other end side is joined to a region on a side separated from the insertion hole in a peripheral edge of the insertion slit on the vehicle body side wall portion side.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a plan view of a vehicle on which a pedestrian airbag device according to an embodiment of the present disclosure is mounted.

FIG. **2** is a schematic vertical sectional view taken along a front-rear direction of the pedestrian airbag device of the embodiment, and illustrates a site of an inflator.

FIG. **3** is a schematic vertical sectional view taken along the front-rear direction of the pedestrian airbag device of the embodiment, and illustrates a site of a mounting bracket.

FIG. **4** is a schematic vertical sectional view taken along a left-right direction which illustrates the site of the inflator in the pedestrian airbag device of the embodiment.

FIG. **5** is a plan view illustrating a state where an airbag used in the pedestrian airbag device of the embodiment is flatly deployed.

FIG. **6** is a bottom view illustrating a state where the airbag in FIG. **5** is flatly deployed.

FIG. **7** is a partially enlarged plan view illustrating an insertion opening portion in the airbag in FIG. **5**.

FIG. **8** is a partially enlarged bottom view illustrating the insertion opening portion in the airbag in FIG. **5**.

FIG. **9** is a partially enlarged sectional view illustrating a site of the insertion opening portion in the airbag in FIG. **5**.

FIG. **10** is a schematic exploded perspective view illustrating the site of the insertion opening portion in the airbag in FIG. **5**.

FIG. **11** is a plan view of an inner tube used in the pedestrian airbag device of the embodiment.

FIG. **12** is a plan view in which base materials forming the airbag in FIG. **5** are aligned.

FIG. **13** is a plan view of a guide tether.

FIG. **14** is a partially enlarged sectional view illustrating a state where a lid panel is opened in the airbag in FIG. **5**.

FIGS. **15**A and **15**B are partially enlarged vertical sectional views illustrating a process of inflating the airbag in the pedestrian airbag device of the embodiment.

FIG. **16** is a schematic plan view illustrating a state where the airbag is completely inflated in the pedestrian airbag device of the embodiment.

FIG. **17** is a schematic vertical sectional view illustrating a state where the airbag is completely inflated in the pedestrian airbag device of the embodiment.

DETAILED DESCRIPTION

Exemplary embodiments of the present disclosure are described below with reference to the accompanying draw-

ings. However, the invention is not limited to the embodiments disclosed herein. All modifications within the appended claims and equivalents relative thereto are intended to be encompassed in the scope of the claims.

Hereinafter, an embodiment of the present disclosure will be described with reference to the drawings. A pedestrian airbag device M (hereinafter, abbreviated as an "airbag device") of the embodiment is mounted near a rear end **15***c* of a hood panel **15** in a vehicle V. As illustrated in FIGS. **1** to **4**, the airbag device M of the embodiment is disposed at a position close to the rear end **15***c* of the hood panel **15**, which is an approximately center position in a left-right direction of the vehicle V between right and left front pillars **5**L and **5**R. In the present specification, unless otherwise specified, description will be made so that front-rear, up-down, and left-right directions respectively coincide with front-rear, up-down, and left-right directions of the vehicle V.

As illustrated in FIG. **1**, the hood panel **15** is disposed to cover an upper side of an engine room in the vehicle V. The hood panel **15** is connected to a body **1** side of the vehicle V so that a front portion is openable and closable by a hinge portion (not illustrated) disposed near the rear end **15***c* on both right and left edge sides. In a case of the embodiment, the hood panel **15** is formed of a plate material such as a steel plate and an aluminum (aluminum alloy) plate, and includes an outer panel **15***a* and an inner panel **15***b* as illustrated in FIGS. **2** and **3**. In the hood panel **15**, the rear end **15***c* side is curved in the left-right direction so that a center in the left-right direction is located forward and both right and left end sides are located rearward in accordance with a front windshield **4** (to be described later) (refer to FIG. **1**).

As illustrated in FIGS. **2**, **3**, and **17**, a cowl **7** is disposed behind the hood panel **15**. The cowl **7** includes a highly rigid cowl panel **7***a* located on the body **1** side and a synthetic resin-made cowl louver **7***b* located above the cowl panel **7***a*. The cowl louver **7***b* is disposed so that a rear end side is connected to a lower portion **4***a* side of the front windshield **4**. The cowl **7** is curved to match a curved shape of the rear end **15***c* of the hood panel **15** (refer to FIG. **1**). In addition, as illustrated in FIG. **1**, a wiper **8** is disposed in a site of the cowl **7**. As indicated by a two-dot chain line in FIGS. **2**, **3**, and **17**, the wiper **8** is disposed to protrude upward from the cowl louver **7***b*. The front pillars **5**L and **5**R are disposed on right and left outer sides of the front windshield **4**.

As illustrated in FIGS. **1** to **4**, the airbag device M includes an airbag **45**, an inflator **30** that supplies an inflating gas to the airbag **45**, a case **20** serving as an accommodation site for accommodating the airbag **45** and the inflator **30**, an airbag cover **25** that covers the folded airbag **45**, and mounting brackets **110** that mount mounting piece portions **80** (to be described) of the airbag **45** on the case **20**.

As illustrated in FIGS. **2** and **3**, the case **20** serving as the accommodation site is formed of sheet metal, and has a substantially box shape including a bottom wall portion **21** and a peripheral wall portion **22** extending upward from the bottom wall portion **21**, having an open upper end side, and having a substantially square tubular shape. In addition, the case **20** has a configuration in which the inflated airbag **45** protrudes from a protrusion opening **20***a* on the upper end side. The bottom wall portion **21** has mounting holes **21***a* for fixing and mounting nuts **42** and **114** by respectively inserting mounting bolts **39** for mounting the inflator **30** and mounting bolts **112** for mounting the mounting piece portions **80** of the airbag **45** (refer to FIGS. **2** to **4**). In a case of the embodiment, the case **20** is disposed so that a front side region is located directly below the rear end **15***c* of the hood panel **15** and a rear side region is located rearward of the hood panel **15**. The case **20** is mounted on the cowl panel **7***a* on the body **1** side by using a bracket (not illustrated).

The airbag cover **25** is formed of a soft synthetic resin such as a polyolefin-based thermoplastic elastomer (TPO). The airbag cover **25** is disposed to cover a protrusion opening **20***a* on an upper end side of the case **20**, and has a door portion **26** that can be opened rearward by being pushed by the airbag **45** when the airbag **45** is deployed and inflated (refer to FIGS. **2**, **3**, and **17**). The airbag cover **25** is mounted on the case **20** at a predetermined location by using mounting means (not illustrated).

The inflator **30** includes an inflator main body **31** serving as a main body portion and a mounting bracket **35** for mounting the inflator main body **31** on the case **20**.

The inflator main body **31** serving as the main body portion is a cylinder type having a substantially columnar outer shape. As illustrated in FIGS. **2** and **4**, the inflator main body **31** is disposed inside a substantially central position in front-rear and left-right directions of a cowl cover portion **48** (to be described later) in the airbag **45** so that an axial direction substantially extends along the left-right direction. Specifically, the inflator main body **31** is disposed at a position slightly rearward of the center in the front-rear direction of the cowl cover portion **48** (refer to a two-dot chain line in FIGS. **5** and **6**). As illustrated in FIG. **4**, the inflator main body **31** is configured so that a gas discharge portion **32** capable of discharging the inflating gas is disposed on one end side (in a case of the embodiment, a right end **31***b* side) in the axial direction, and is electrically connected to an operation circuit (not illustrated) via a lead wire (not illustrated) extending from the other end side (left end **31***a* side) in the axial direction. A sensor (not illustrated) capable of detecting collision with a pedestrian is disposed in a front bumper **6** (refer to FIG. **1**) of the vehicle V on which the airbag device M of the embodiment is mounted. The operation circuit activates the inflator main body **31** when the sensor detects the collision between the vehicle V and the pedestrian, based on a signal from the sensor.

As illustrated in FIGS. **2** and **4**, the mounting bracket **35** for mounting the inflator main body **31** on the case **20** includes a holding portion **36** that holds the inflator main body **31** and a plurality of (three in a case of the embodiment) mounting bolts **39** protruding downward from the holding portion **36**. The holding portion **36** is formed of sheet metal, and has a strip shape extending substantially along the left-right direction (axial direction of the inflator main body **31**) to support a lower surface side of the inflator main body **31**. In the holding portion **36**, support piece portions **37** for supporting the inflator main body **31** are formed to protrude to both front and rear sides at a plurality of locations (three locations in a case of the embodiment) along the left-right direction. Each of the support piece portions **37** is formed to be capable of supporting an outer peripheral surface of the inflator main body **31**, and be inclined to extend upward from front and rear edge portions of the holding portion **36** while a tip faces outward in the front-rear direction. Each of the support piece portions **37** has a symmetrical shape in the front-rear direction (refer to FIG. **2**). In a case of the embodiment, as illustrated in FIG. **4**, each of the support piece portions **37** is formed at a position corresponding to the mounting bolt **39**. The mounting bolts **39** are formed to respectively protrude downward at three locations such as both right and left end sides of the holding portion **36** and a substantially central location in the left-right direction. In the embodiment, the mounting bracket **35** is configured to mount the inflator main body **31**

by winding clamps **40** from an outer peripheral side in a state where the inflator main body **31** is held by the holding portion **36**. In a case of the embodiment, the clamps **40** are disposed at two locations on both right and left end sides of the holding portion **36** (refer to FIG. **4**).

That is, in the inflator **30** of the embodiment, as illustrated in FIGS. **3** and **4**, each of the mounting bolts **39** is disposed to protrude from an outer peripheral surface **31***c* of the inflator main body **31** serving as the main body portion in an axis orthogonal direction (downward direction) of the inflator main body **31**. The inflator **30** is inserted into the airbag **45** by using the clamps **40** in a state where the inflator main body **31** is mounted on the mounting bracket **35**, and is mounted on the bottom wall portion **21** of the case **20**. Specifically, the inflator main body **31** and the holding portion **36** in the mounting bracket **35** are inserted into the airbag **45** so that the mounting bolts **39** protrude outward from insertion holes **52** and mounting holes **56** (to be described later). Specifically, the inflator **30** causes each of the mounting bolts **39** protruding from a lid panel **54** (to be described later) in the airbag **45** to protrude from the bottom wall portion **21** of the case **20**, and mounts the mounting bolts **39** by fixing the nut **42** together with the airbag **45** on the case **20** (refer to FIG. **2**). In addition, in the embodiment, the inflator **30** is accommodated inside the airbag **45** by covering an outer peripheral side of the inflator main body **31** and the holding portion **36** in the mounting bracket **35** with a flexible tubular inner tube **85**. The inflator **30** (inflator main body **31**) is accommodated at a position slightly rearward of the center in the front-rear direction of the cowl cover portion **48** in the airbag **45** so that the center in the axial direction substantially coincides with the center in the left-right direction of the bag main body **46** (refer to FIGS. **5** and **6**). More specifically, the inflator **30** (inflator main body **31**) is accommodated inside the cowl cover portion **48** so that the right end **31***b* side on which the gas discharge portion **32** is disposed is located rightward of the lid panel **54** (that is, rightward of an insertion slit **51** (to be described later)) and the left end **31***a* side is located rightward of a left edge of the lid panel **54** (refer to FIG. **8**).

As illustrated in FIGS. **5** to **10**, the airbag **45** includes a bag main body **46** inflated by the inflating gas inside, and tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, **62**CR, **64**L, **64**R, **65**, **66**L, and **66**R that regulate the thickness of the bag main body **46** when the bag main body **46** is completely inflated, a guide tether **70** for guiding when the inflator is inserted into the bag main body **46**, two mounting piece portions **80** (**80**L and **80**R) for mounting the vehicle body side wall portion **46***a* side of the bag main body **46** on the case **20**, and an inner tube **85** that covers an outer peripheral side of the inflator **30** inside the bag main body **46**. In addition, the bag main body **46** has the insertion opening portion **50** for inserting the inflator **30** into the bag main body **46**.

An outer shape of the bag main body **46** when the inflation is completed is a substantially U-shape which is wide in the left-right direction when viewed from a front surface side. The bag main body **46** includes the cowl cover portion **48** disposed substantially along a lower portion **4***a* of the front windshield **4** and substantially along the left-right direction, and pillar cover portions **60**L and **60**R respectively extending rearward from both ends of the cowl cover portion **48** and covering the lower portion **5***a* side of the front surface of the right and left front pillars **5**L and **5**R. In addition, the bag main body **46** has a vehicle body side wall portion **46***a* disposed on the body **1** side when the inflation is completed, and a pedestrian side wall portion **46***b* disposed to face the vehicle body side wall portion **46***a*, and has a bag shape by joining (sewing) outer peripheral edges of the vehicle body side wall portion **46***a* and the pedestrian side wall portion **46***b* to each other over an entire periphery.

The cowl cover portion **48** covers an upper surface side of a region from the rear end **15***c* of the hood panel **15** to the cowl **7** when the inflation is completed. Specifically, in a case of the embodiment, when the inflation is completed, the cowl cover portion **48** covers an upper surface side (front side) of a region from a site on the rear end **15***c* side of the hood panel **15** to the lower portion **4***a* side of the front windshield **4** through the cowl **7**, over a substantially entire region including the wiper **8** in a vehicle width direction (left-right direction) (refer to FIGS. **16** and **17**). In the airbag **45** of the embodiment, the inflator **30** is accommodated at a substantially central position in the front-rear and left-right directions in the cowl cover portion **48**. Specifically, in the vehicle body side wall portion **46***a* of the airbag **45**, a substantially central region in the front-rear and left-right directions of the cowl cover portion **48** forms the insertion opening portion **50** for inserting the inflator **30** into the airbag **45** (refer to FIGS. **6** and **8**).

Specifically, the inflator **30** is accommodated at a position slightly rearward of the center in the front-rear direction of the cowl cover portion **48**. The insertion opening portion **50** is also disposed at the position slightly rearward of the center in the front-rear direction of the cowl cover portion **48**. Specifically, in the vehicle body side wall portion **46***a*, the insertion opening portion **50** is disposed in a region between front side tethers **64**L and **64**R and rear side tether **65** (to be described later). As illustrated in FIGS. **8** to **10**, the insertion opening portion **50** includes an insertion slit **51** formed in the vehicle body side wall portion **46***a*, insertion holes **52** for causing the mounting bolts **39** of the inflator **30** to protrude, and a lid panel **54** for closing the insertion slit **51** from an outer peripheral side. The insertion slit **51** is used for inserting the inflator **30** (inflator main body **31**), and is formed in a linear shape substantially extending along the left-right direction to substantially extend along the axial direction of the inflator main body **31**. A length dimension of the insertion slit **51** is set to be smaller than a length dimension of the inflator main body **31** (refer to FIG. **8**). In a case of the embodiment, the insertion slit **51** is disposed so that the center of it is shifted leftward of the center of the bag main body **46** in the left-right direction (which substantially coincides with the position of the insertion hole **52** in the center) (refer to FIG. **8**). The insertion holes **52** cause the mounting bolts **39** of the inflator **30** to protrude, and are disposed at a position separated from the insertion slit **51** on a side in a substantially orthogonal direction, and in a case of the embodiment, on a front side of the insertion slit **51**. The insertion holes **52** are formed to correspond to the mounting bolts **39** at three locations along the left-right direction. The lid panel **54** is a separate member formed of a flexible sheet body, and has a substantially rectangular outer shape in which a side in the left-right direction is wide so that the insertion slit **51** can be closed on the outer peripheral side of the vehicle body side wall portion **46***a*. The lid panel **54** is also disposed so that the center in the left-right direction is shifted leftward of the center in the left-right direction in the bag main body **46**. In a case of the embodiment, the lid panel **54** is sewn (joined) by using a suture so that the rear end **54***b* side is a side separated from the insertion hole **52** across the insertion slit **51** in the vehicle body side wall portion **46***a*, that is, so that a joining site **55** is formed in a rear region of the insertion slit **51** in the vehicle body side wall portion **46***a*. The mounting holes **56** for causing the mounting bolts **39** to protrude to correspond

to the insertion holes **52** are formed on a front end **54***a* side of the lid panel **54**. The joining site **55** for sewing (joining) the rear end **54***b* side of the lid panel **54** to the vehicle body side wall portion **46***a* is continuously formed over the entire region in the left-right direction of the lid panel **54**. In a case of the embodiment, as illustrated in FIG. **12**, the lid panel **54** is formed of a lid panel base fabric **103**.

In a case of the embodiment, as tethers that regulate the thickness of the bag main body **46** when the inflation is completed, front-rear tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, and **62**CR, the front side tethers **64**L and **64**R, the rear side tether **65**, and end side tethers **66**L and **66**R are disposed inside the bag main body **46**. Each of the front-rear tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, and **62**CR, the front side tethers **64**L and **64**R, the rear side tether **65**, and the end side tethers **66**L and **66**R connects the pedestrian side wall portion **46***b* and the vehicle body side wall portion **46***a* to each other, thereby regulating a separation distance between the pedestrian side wall portion **46***b* and the vehicle body side wall portion **46***a* when the inflation is completed (refer to FIG. **17**). The front side tethers **64**L and **64**R are disposed to substantially extend along the left-right direction on the front side of the insertion opening portion **50**, at positions slightly forward of the center in the front-rear direction of the cowl cover portion **48**. The rear side tether **65** is disposed to substantially extend along the left-right direction on the rear side of the insertion opening portion **50**. The rear side tether **65** is configured to have different width dimensions so that the joining site to the vehicle body side wall portion **46***a* is wider in the left-right direction than the joining site to the pedestrian side wall portion **46***b* (refer to FIGS. **5**, **6**, and **12**). The front-rear tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, and **62**CR are respectively disposed in one location at a position outward in the left-right direction of each of the front side tethers **64**L and **64**R, and in two locations on the front side of each of the front side tethers **64**L and **64**R, and are aligned to substantially extend along the front-rear direction, on a side in the left-right direction. The front-rear tethers **62**AL and **62**AR disposed outward in the left-right direction of the front side tethers **64**L and **64**R are disposed to extend rearward of the front side tethers **64**L and **64**R, and the width dimensions are set to be larger than those of the remaining front-rear tethers **62**BL, **62**CL, **62**BR, and **62**CR. In a case of the embodiment, opening portions **62***a* and **64***a* which are open so that the inflating gas can flow are respectively formed in the front side tethers **64**L and **64**R and the front-rear tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, and **62**CR (refer to FIGS. **5** and **12**). In each of the front-rear tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, and **62**CR, the opening portions **62***a* are formed one by one as elongated holes substantially extending along an up-down direction. In each of the front side tethers **64**L and **64**R, opening portions **64***a* are formed two by two in an elongated hole shape substantially extending along the up-down direction. The end side tethers **66**L and **66**R are disposed to be inclined in the left-right direction so that the insides in the left-right direction are respectively located rearward near a boundary site between the cowl cover portion **48** and each of the pillar cover portions **60**L and **60**R. The front-rear tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, and **62**CR, the front side tethers **64**L and **64**R, the rear side tether **65**, and the end side tethers **66**L and **66**R are symmetrically disposed inside the bag main body **46**.

The guide tether **70** for guiding when the inflator is inserted is disposed in a disposition region of the insertion opening portion **50**, and is formed of a flexible sheet body. The guide tether **70** is disposed inside the bag main body **46** so that one end side (upper end **70***a* side when mounted on the vehicle) is joined to the pedestrian side wall portion **46***b*, and the other end side (lower end **70***b* side when mounted on the vehicle) is joined to a region on a side separated from the insertion hole **52** in a peripheral edge of the insertion slit **51** on the vehicle body side wall portion **46***a* side. Specifically, in the guide tether **70**, the guide tether **70** has the width dimension on a side in a direction (side in the left-right direction) extending along the axial direction of the inflator main body **31** which is substantially the same as the length dimension of the insertion slit **51** in the insertion opening portion **50**, and is configured to include a strip-shaped body which is wide in the left-right direction. In the guide tether **70**, an upper end **70***a* side is sewn (joined) to the pedestrian side wall portion **46***b* to form a joining site **74**, and a lower end **70***b* side is joined to an inner peripheral surface **54***c* side of the lid panel **54** so that the lower end **70***b* side is inserted into the insertion slit **51**. The joining site **75** that joins the lower end **70***b* of the guide tether **70** to the inner peripheral surface **54***c* side of the lid panel **54** is disposed at a position rearward of the mounting hole **56**, which is a position slightly rearward of the center of the lid panel **54** in the front-rear direction. The joining site **75** is continuously formed over the entire region in the width direction of the guide tether **70**. The joining site **74** that joins the upper end **70***a* side of the guide tether **70** to the pedestrian side wall portion **46***b* is also continuously formed over the entire region in the width direction of the guide tether **70**. The guide tether **70** is disposed to cover the rear side of the inflator **30** (inflator main body **31**) when mounted on the vehicle (refer to FIG. **2**). The guide tether **70** is inserted into the insertion slit **51** by setting the width dimension on the side in the left-right direction to be substantially the same as the length dimension of the insertion slit **51** in the insertion opening portion **50**. In other words, the guide tether **70** is set so that the width dimension is smaller than the length dimension of the inflator main body **31**. That is, the guide tether **70** is also disposed so that the center in the left-right direction is shifted leftward of the center in the left-right direction in the bag main body **46**. In a case of the embodiment, the length dimension of the insertion slit **51** (width dimension of the guide tether **70**) is set to approximately ⅔ of the length dimension of the inflator main body **31** so that the inflator main body **31** can smoothly be inserted. In addition, the guide tether **70** is set so that the width dimension on the side in the left-right direction is smaller than the length dimension of the inner tube **85** (mounting side portion **86**) (refer to FIG. **7**). In a state where the inflator **30** is accommodated inside the bag main body **46**, the guide tether **70** is disposed to cover the rear side of the central region excluding both right and left end sides in the inner tube **85**. Specifically, the guide tether **70** is disposed to cover the rear side of the outflow opening **89**L on the left end **88***a* side of a gas flow straightening portion **88** (to be described later) and the gas outlet **91**BL on the left side in the inner tube **85** (FIG. **7**). When the airbag **45** is deployed and inflated, the guide tether **70** suppresses a possibility that the inflating gas flowing out from the outflow opening **89**L and the gas outlet **91**BL may flow rearward, and deflects the flow to both right and left sides.

In addition, in the guide tether **70**, a planned breakable portion **71** configured to be provided with an intermittent cut substantially extending along the left-right direction is disposed near the lower end **70***b* joined to the lid panel **54** (refer to FIGS. **10** and **13**). As illustrated in FIG. **13**, the planned breakable portion **71** is formed over the entire region of the guide tether **70** in the left-right direction, and breaks a

peripheral edge site (connection site **73**) between the cuts **72** when the airbag **45** is inflated. In this manner, the guide tether **70** is divided over the entire region in the left-right direction, thereby releasing a connection state between the pedestrian side wall portion **46***b* and the insertion slit **51** side (vehicle body side wall portion **46***a* side) which are connected by the guide tether **70** (refer to FIGS. **15**B and **17**). The planned breakable portion **71** is disposed near the lower end **70***b* of the guide tether **70**, and is disposed at a position near the insertion slit **51** in a state where the lower end **70***b* side is joined to the lid panel **54** (refer to FIG. **9**). At the initial inflating stage of the bag main body **46**, as illustrated in FIG. **15**A, the guide tether **70** maintains the connection state between the pedestrian side wall portion **46***b* side and the lid panel **54** side (vehicle body side wall portion **46***a* side). When the bag main body **46** is inflated to greatly separate the pedestrian side wall portion **46***b* from the vehicle body side wall portion **46***a* side, the planned breakable portion **71** is broken and divided due to tension generated in the guide tether **70** breaks as illustrated in FIG. **15**B. The guide tether **70** is set so that the length dimension is shorter than those of other tethers (front-rear tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, and **62**CR, front side tethers **64**L and **64**R, rear side tether **65**, and end side tethers **66**L and **66**R). The length dimension of the guide tether **70** and the separation distance (width dimension of the connection site **73**) between the cuts **72** in the planned breakable portion **71** are set to a dimension as follows. According to the dimension, at the initial inflating stage of the airbag **45**, as described above, it is possible to suppress the rearward outflow of the inflating gas flowing out from the outflow opening **89**L and the gas outlet **91**BL in the inner tube **85**, and it is possible to timely break the planned breakable portion **71** not to hinder quick completion of the inflation of the whole bag main body **46**.

Mounting piece portions **80** for mounting the vehicle body side wall portion **46***a* side of the bag main body **46** on the case **20** are disposed on both right and left sides of the insertion opening portion **50**. The mounting piece portions **80** are configured to include a flexible sheet body as a separate body from the bag main body **46**. As illustrated in FIGS. **3** and **6**, a front end side and a rear end side of each of the mounting piece portions **80** are joined (sewn) to the vehicle body side wall portion **46***a*. The mounting piece portions **80** (**80**L and **80**R) are configured to be mounted on the bottom wall portion **21** of the case **20** by using the mounting brackets **110**. In a case of the embodiment, as illustrated in FIG. **6**, the mounting piece portions **80** (**80**L and **80**R) are disposed between the insertion opening portion **50** and the end side tethers **66**L and **66**R in a state where the bag main body **46** is flatly deployed, and are disposed at two locations which are substantially symmetrical in the left-right direction, on the rear side of the front side tethers **64**L and **64**R. The mounting piece portions **80** (**80**L and **80**R) are used for inserting a mounting plate **111** (to be described later) of the mounting bracket **110** between the mounting piece portions **80** (**80**L, **80**R) and the vehicle body side wall portion **46***a* (refer to FIG. **3**), and have through-holes **80***a* into which the mounting bolts **112** (to be described later) formed in the mounting bracket **110** can be inserted.

The inner tube **85** that covers the outer peripheral side of the inflator **30** (the inflator main body **31** and the holding portion **36** in the mounting bracket **35**) is configured to include a flexible sheet body. As illustrated in FIG. **11**, the inner tube **85** is configured to include a mounting side portion **86** covering the outer peripheral side of the inflator main body **31** and causing the mounting bolts **39** to protrude, and a gas flow straightening portion **88** that straightens a flow of the inflating gas discharged from the gas discharge portion **32** of the inflator main body **31**.

The mounting side portion **86** is configured to have a strip shape whose longitudinal direction extends along the axial direction of the inflator main body **31** so that the outer peripheral side of the inflator main body **31** can be covered. Insertion holes **86***c* for causing the mounting bolt **39** of the mounting bracket **35** to protrude are formed at three positions along the longitudinal direction, at a substantially central position in the width direction in the mounting side portion **86** (refer to FIG. **12**). The mounting side portion **86** is configured so that the outer peripheral side of the inflator main body **31** can be covered except for the upper surface side in a mount state on the vehicle, and the width dimension on a side in longitudinal direction (side in the left-right direction) is set to be larger than the length dimension of the inflator main body **31**. That is, the width dimension of the mounting side portion **86** on the side in the left-right direction is set to be larger than the width dimension of the guide tether **70** on the side in the left-right direction. In a state where the mounting side portion **86** is accommodated inside the bag main body **46** together with the inflator **30**, the right end **86***b* is located rightward of a right edge **70***d* of the guide tether **70**, and the left end **86***a* is located leftward of a left edge **70***c* of the guide tether **70** (refer to FIG. **7**).

The gas flow straightening portion **88** has a substantially tubular shape in both right and left end sides are open. The gas flow straightening portion **88** has a substantially tubular shape by joining the tips to each other to extend from a front edge **86***d* side and a rear edge **86***e* side of the mounting side portion **86**. Specifically, the gas flow straightening portion **88** has a substantially tubular shape so that a right end **88***b* coincides with a right end **86***b* of the mounting side portion **86** to increase the diameter toward the left side. The gas flow straightening portion **88** is configured to be wide in the left-right direction so that a left end **88***a* is disposed at a position slightly leftward of the center in the left-right direction of the mounting side portion **86**. The outflow openings **89**L and **89**R through which the inflating gas flows are disposed on the left end **88***a* side in the gas flow straightening portion **88** and the right end **88***b* side that coincides with the right end **86***b* of the mounting side portion **86**. As described above, the gas flow straightening portion **88** has a substantially tubular shape whose diameter increases toward the left side which is the center side in the left-right direction. Although detailed illustration is omitted, the outflow opening **89**L on the left side has an opening area larger than that of the outflow opening **89**R on the right side. In addition, in the gas flow straightening portion **88**, a gas outlet **91** through which the inflating gas flows out is disposed in a region of the peripheral wall **90**. The gas outlets **91** are respectively aligned at two locations on the side in the front-rear direction, and at two locations on the side in the left-right direction. The four gas outlets **91** are disposed in total. In the gas flow straightening portion **88**, the left end **88***a* side (outflow opening **89**L on the left side) located on center side in the left-right direction and the gas outlets **91**FL and **91**BL on the left side are disposed in a region overlapping the guide tether **70** in the front-rear direction (refer to FIG. **7**). When accommodated inside the bag main body **46**, the rear side of the outflow opening **89**L and the gas outlets **91**FL and **91**BL is covered by the guide tether **70**. That is, in the gas flow straightening portion **88**, the right end **88***b* side (outflow opening **89**R on the right side) and the gas outlets **91**FR and **91**BR on the right side are disposed in a region where the rear side is not covered by the

guide tether **70**, when accommodated inside the bag main body **46**. The inner tube **85** is formed of an inner tube base fabric **105** illustrated in FIG. **12**, and has a tubular shape by folding the inner tube base fabric **105** in half and joining (sewing) corresponding edge portions to each other.

As illustrated in FIG. **12**, the airbag **45** of the embodiment includes a vehicle body side base fabric **95** forming the vehicle body side wall portion **46***a* of the bag main body **46**, a pedestrian side base fabric **96** forming the pedestrian side wall portion **46***b* of the bag main body **46**, tether base fabrics **98**A, **98**B, **99**, **100**, and **101** respectively forming the front-rear tethers **62**AL, **62**BL, **62**CL, **62**AR, **62**BR, and **62**CR, the front side tethers **64**L and **64**R, the rear side tether **65**, and the end side tethers **66**L and **66**R, a lid panel base fabric **103** forming the lid panel **54**, the guide tether **70**, an inner tube base fabric **105** forming the inner tube **85**, and the mounting piece portions **80**. In the base fabrics (base materials), a coated fabric coated with a coating agent for preventing a gas leakage is cut into a predetermined shape, and is formed on a surface of a woven fabric formed by weaving polyamide yarn or polyester yarn.

The mounting brackets **110** for mounting the mounting piece portions **80** (**80**L and **80**R) on the bottom wall portion **21** of the case **20** respectively include a substantially rectangular plate-shaped mounting plate **111** and mounting bolts **112** protruding downward from the mounting plate **111**. As illustrated by a two-dot chain line in FIG. **6**, the outer shape of the mounting plate **111** is a substantially rectangular plate shape which is wide on the side in the left-right direction. Although detailed illustration is omitted, the mounting bolts **112** are aligned at two locations along the left-right direction. The mounting bracket **110** is configured to mount the mounting piece portion **80** on the bottom wall portion **21** of the case **20** by causing the mounting bolts **112** protruding from the mounting piece portion **80** to protrude from the bottom wall portion **21** of the case **20** and fixing the nut **114** (refer to FIG. **3**).

Next, mounting the airbag device M of the embodiment on the vehicle V will be described. In the inflator **30**, the mounting bracket **35** holds the inflator main body **31** by using the clamps **40**. In this state, the mounting bolts **39** protrudes from the insertion holes **86***c*, and are inserted into the mounting side portion **86** of the inner tube **85**. In this case, although detailed illustration is omitted, the inner tube **85** including the gas flow straightening portion **88** is wound around the inflator main body **31** by using a tape material (not illustrated) which can be broken when the inflating gas is discharged from the gas discharge portion **32**. The airbag **45** is folded so that the airbag **45** can be accommodated inside the case **20**. Specifically, although detailed illustration is omitted, in order to secure an accommodation space of the inflator **30**, a dummy inflator having an outer shape substantially the same as that of the inflator **30** is accommodated in the airbag **45**. In a state where the bag main body **46** is flatly deployed so that the pedestrian side wall portion **46***b* overlaps the vehicle body side wall portion **46***a*, the airbag **45** is folded to be accommodated inside the case **20** by reducing the width dimension between the side in the front-rear direction and the side in the left-right direction. Thereafter, the periphery of the folded airbag **45** (completely folded body) is wrapped with a breakable wrapping material (not illustrated) for preventing a folding failure. In this case, a site between the insertion opening portion **50** and the mounting piece portions **80** in the airbag **45** is exposed from the wrapping material. The lid panel **54** in the insertion opening portion **50** is opened, and the dummy inflator is pulled out from the insertion slit **51**. The dummy inflator is taken out from the completely folded body (bag main body **46**). The inflator **30** in a state where the inner tube **85** is externally wound as described above is inserted into the completely folded body (bag main body **46**) through the insertion slit **51**. The inflator **30** is accommodated inside the bag main body **46**. In this case, each of the mounting bolts **39** protrudes from the insertion hole **52**. Thereafter, the lid panel **54** is closed to cover the insertion slit **51**, and each of the mounting bolts **39** is inserted into the mounting hole **56** on the front end **54***a* side of the lid panel **54**. In addition, the mounting bracket **110** is mounted on each of the mounting piece portions **80** to manufacture an airbag assembly. Thereafter, the airbag assembly is accommodated inside the case **20** so that the respective mounting bolts **39** and **112** are protruded from the bottom wall portion **21**, and the nuts **42** and **114** are fastened to the respective mounting bolts **39** and **112** protruding from the bottom wall portion **21**. The airbag **45** and the inflator **30** can be mounted on the case **20**. Thereafter, when the airbag cover **25** is mounted on the case **20**, a bracket (not illustrated) extending from the case **20** is mounted on the cowl panel **7***a*, and the inflator main body **31** is connected to an operation circuit (not illustrated), the airbag device M can be mounted on the vehicle V.

In the airbag device M of the embodiment, when an operation circuit (not illustrated) detects a collision between the vehicle V and a pedestrian, based on a signal from a sensor (not illustrated) disposed in the front bumper **6**, the inflator **30** is activated, and the inflating gas flows into the airbag **45** to be inflated. The inflated airbag **45** pushes and opens the door portion **26** of the airbag cover **25**. While the airbag **45** protrudes upward from the protrusion opening **20***a* of the case **20** formed by pushing and opening the door portion **26**, the inflation of the airbag **45** is completed to cover the lower portion **5***a* side of the front surface of the front pillars **5**L and **5**R from the upper surface of the rear end **15***c* of the hood panel **15** to the upper surface of the cowl **7** (refer to FIGS. **16** and **17**).

In the airbag device M of the embodiment, in the guide tether **70** for guiding when the inflator **30** is inserted, one end (upper end **70***a*) side is joined to the pedestrian side wall portion **46***b*, and the other end (lower end **70***b*) side is joined to the vehicle body side wall portion **46***a* side so that the pedestrian side wall portion **46***b* and the vehicle body side wall portion **46***a* are connected to each other. In this manner, the guide tether **70** is disposed to partition an internal region of the airbag **45** (bag main body **46**). In the guide tether **70**, the lower end **70***b* side joined to the vehicle body side wall portion **46***a* side is joined to a region on the side separated from the insertion hole **52** for causing the mounting bolt **39** of the inflator **30** to protrude, in the peripheral edge of the insertion slit **51** for inserting the inflator main body **31** serving as the main body portion of the inflator **30**. That is, in the airbag device M of the embodiment, the region on the side separated from the insertion hole **52** in the peripheral edge of the insertion slit **51** is at least partially closed by the guide tether **70**. In this aspect, the guide tether **70** interferes with the inflator main body **31** inserted into the airbag **45** through the insertion slit **51**, and can regulate erroneous insertion into the side separated from the insertion hole **52** (rear side of the insertion slit **51** when mounted on the vehicle). Therefore, even when the inflator main body **31** is internally accommodated in a state of completely folded body formed by folding the airbag **45**, it is possible to suppress an access to a region where the vehicle body side wall portion **46***a* and the pedestrian side wall portion **46***b* are folded and overlapped multiple times. As a result, the inflator main body **31** can stably be inserted into the inser-

tion hole **52** side through the insertion slit **51**, and the mounting bolt **39** can protrude from the insertion hole **52**.

Therefore, in the airbag device M of the embodiment, occurrence of erroneous insertion can be suppressed, satisfactory assembly workability can be ensured, and the inflator **30** can easily be assembled to the airbag **45**.

In addition, in the airbag device M of the embodiment, the insertion opening portion **50** includes the flexible lid panel **54** which can close the insertion slit **51**, on the outer peripheral side of the vehicle body side wall portion **46***a*. The lid panel **54** includes the mounting hole **56** for causing the mounting bolt **39** to protrude to correspond to the insertion hole **52** on the front end **54***a* side so that the rear end **54***b* side is joined to the region on the side separated from the insertion hole **52** across the insertion slit **51** (rear side of the insertion slit **51**) in the vehicle body side wall portion **46***a*. Therefore, in the airbag device M of the embodiment, the outer peripheral side of the insertion slit **51** can be covered by the lid panel **54**. Accordingly, the inflating gas flowing into the airbag **45** can be prevented from leaking from the insertion slit **51**. As a matter of course, if such advantageous effect do not have to be considered, as the insertion opening portion, a configuration excluding the lid panel may be adopted.

Furthermore, in the airbag device M of the embodiment, the guide tether **70** is inserted into the insertion slit **51**, and the lower end **70***b* side is joined to the lid panel **54**. Therefore, when the inflator **30** is accommodated inside the airbag **45**, and when the lid panel **54** is opened from the front end **54***a* side, as illustrated in FIG. **14**, the guide tether **70** is pulled out from the insertion slit **51** by opening the lid panel **54**. As a result, when the inflator main body **31** is inserted into the airbag **45** through the insertion slit **51** and the mounting bolt **39** protrudes from the insertion hole **52**, it is possible to prevent the guide tether **70** from being pinched between the inflator main body **31** and the peripheral edge of the insertion hole **52**. In addition, the guide tether **70** can guide the inflator main body **31** in a long range from the outside of the vehicle body side wall portion **46***a* to the inner peripheral surface side of the airbag **45** (bag main body **46**) through the insertion slit **51**, and thus, more satisfactory assembly workability is achieved. If such advantageous effect do not have to be considered, the lower end side of the guide tether may be joined to the rear edge side of the insertion slit.

In addition, in the airbag device M of the embodiment, the guide tether **70** also serves to regulate the flow of the inflating gas flowing into the bag main body **46** at the initial inflating stage of the airbag **45**. When the airbag **45** is completely inflated, the guide tether **70** breaks the planned breakable portion **71**. In this manner, the connection state between the pedestrian side wall portion **46***b* and the vehicle body side wall portion **46***a* is released, and the regulation of the gas flow is released. The planned breakable portion **71** formed in the guide tether **70** is configured to include the cut **72** intermittently formed over the entire region in the width direction. However, the planned breakable portion **71** is disposed near the lower end **70***b* joined to the lid panel **54**, and is disposed near the insertion slit **51** when the inflator **30** is accommodated. Accordingly, when the inflator main body **31** is inserted into the airbag **45** (bag main body **46**) through the insertion slit **51**, it is possible to accurately suppress a possibility that the inflator main body **31** or the mounting bolt **39** may interfere with the planned breakable portion **71** formed in the guide tether **70**. The workability of inserting the inflator **30** into the airbag **45** is not hindered.

The present disclosure relates to a pedestrian airbag device having the following configuration.

The pedestrian airbag device includes an airbag folded and accommodated inside an accommodation site disposed near a rear end of a hood panel of a vehicle, and an inflator that supplies an inflating gas to the airbag. The airbag is inflated to cover an upper surface on the rear end side of the hood panel.

The inflator includes a main body portion having a substantially columnar outer shape, and a mounting bolt disposed to protrude from an outer peripheral surface of the main body portion in an axis orthogonal direction of the main body portion.

The main body portion is mounted on the accommodation site by using the mounting bolt in a state where the main body portion is inserted into the airbag so that the mounting bolt protrudes outward.

The airbag has a vehicle body side wall portion disposed on a body side when inflation is completed, and a pedestrian side wall portion disposed to face the vehicle body side wall portion, in which peripheral edges of the vehicle body side wall portion and the pedestrian side wall portion are joined to each other to form a bag shape. An insertion opening portion for inserting the inflator into the airbag is provided on the vehicle body side wall portion side.

The insertion opening portion includes an insertion slit formed in the vehicle body side wall portion, substantially extending along an axial direction of the main body portion, and used for inserting the main body portion, and an insertion hole disposed at a position separated from the insertion slit on a side in a substantially orthogonal direction, and used for causing the mounting bolt to protrude.

A guide tether for guiding when the inflator is inserted is disposed inside the airbag so that one end side is joined to the pedestrian side wall portion, and the other end side is joined to a region on a side separated from the insertion hole in a peripheral edge of the insertion slit on the vehicle body side wall portion side.

In the pedestrian airbag device of the present disclosure, in the guide tether for guiding when the inflator is inserted, one end side is joined to the pedestrian side wall portion, and the other end side is joined to the vehicle body side wall portion side so that the pedestrian side wall portion and the vehicle body side wall portion are connected to each other. In this manner, the guide tether is disposed to partition the internal region of the airbag. In the guide tether, the other end side joined to the vehicle body side wall portion side is joined to the region on the side separated from the insertion hole for causing the mounting bolt of the inflator to protrude, in the peripheral edge of the insertion slit for inserting the main body portion of the inflator. That is, in the pedestrian airbag device of the present disclosure, the region on the side separated from the insertion hole in the peripheral edge of the insertion slit is at least partially closed by the guide tether. According to this aspect, the guide tether interferes with the inflator main body portion of the inflator inserted into the airbag through the insertion slit, and can regulate erroneous insertion into the side separated from the insertion hole. Therefore, even when the main body portion of the inflator is internally accommodated in a state of completely folded body formed by folding the airbag, it is possible to suppress the access to the region where the vehicle body side wall portion and the pedestrian side wall portion are folded and overlapped multiple times. As a result, the main body portion of the inflator can stably be inserted into the insertion hole side through the insertion slit, and the mounting bolt can protrude from the insertion hole.

Therefore, in the pedestrian airbag device of the present disclosure, occurrence of erroneous insertion can be suppressed, satisfactory assembly workability can be ensured, and the inflator can easily be assembled to the airbag.

In addition, it is preferable that the pedestrian airbag device of the present disclosure adopts the following configuration. In the insertion opening portion, the flexible lid panel which can close the insertion slit is disposed on the outer peripheral side of the vehicle body side wall portion.

One end side of the lid panel is joined to the region separated from the insertion hole across the insertion slit in the vehicle body side wall portion, and the mounting hole for causing the mounting bolt to protrude to correspond to the insertion hole is disposed on the other end side.

According to this configuration of the airbag device, the outer peripheral side of the insertion slit can be covered by the lid panel. Therefore, the inflating gas flowing into the airbag can be prevented from leaking from the insertion slit.

Furthermore, in the pedestrian airbag device having the above configuration, when the other end side is joined to the lid panel by inserting the guide tether into the insertion slit, when the inflator is accommodated inside the airbag, and when the lid panel is opened from the other end side, the guide tether can be pulled out from the insertion slit by opening the lid panel. Therefore, when the main body portion of the inflator is inserted into the airbag through the insertion slit, and the mounting bolt protrudes from the insertion hole, the guide tether can be prevented from being pinched between the main body portion and the peripheral edge of the insertion hole. In addition, the guide tether can guide the main body portion of the inflator in a long range from the outside of the vehicle body side wall portion to the inner peripheral surface side of the airbag through the insertion slit, and thus, more satisfactory assembly workability is preferably achieved.

What is claimed is:

1. A pedestrian airbag device comprising:

an airbag folded and accommodated inside an accommodation site disposed near a rear end of a hood panel of a vehicle; and

an inflator that supplies an inflating gas to the airbag,

wherein the airbag is inflated to cover an upper surface on the rear end side of the hood panel,

the inflator includes a main body portion having a substantially columnar outer shape, and a mounting bolt disposed to protrude from an outer peripheral surface of the main body portion in an axis orthogonal direction of the main body portion,

the main body portion is mounted on the accommodation site by using the mounting bolt in a state where the main body portion is inserted into the airbag so that the mounting bolt protrudes outward,

the airbag has a vehicle body side wall portion disposed on a body side when inflation is completed, and a pedestrian side wall portion disposed to face the vehicle body side wall portion, in which peripheral edges of the vehicle body side wall portion and the pedestrian side wall portion are joined to each other to form a bag shape, and an insertion opening portion for inserting the inflator into the airbag is provided on the vehicle body side wall portion side,

the insertion opening portion includes an insertion slit formed in the vehicle body side wall portion, substantially extending along an axial direction of the main body portion, and used for inserting the main body portion, and an insertion hole disposed at a position separated from the insertion slit on a side in a substantially orthogonal direction, and used for causing the mounting bolt to protrude,

a guide tether for guiding when the inflator is inserted is disposed inside the airbag so that one end side is joined to the pedestrian side wall portion, and the other end side is joined to a region on a side separated from the insertion hole in a peripheral edge of the insertion slit on the vehicle body side wall portion side,

the insertion opening portion includes a flexible lid panel configured to close the insertion slit on an outer peripheral side of the vehicle body side wall portion,

the lid panel is configured so that one end side is joined to a region on a side separated from the insertion hole across the insertion slit in the vehicle body side wall portion, and a mounting hole for causing the mounting bolt to protrude to correspond to the insertion hole is disposed on the other end side, and

the other end side of the guide tether is joined to the lid panel so that the guide tether is inserted into the insertion slit.

2. The pedestrian airbag device according to claim **1**,

wherein the airbag includes a cowl cover portion that covers an upper surface side of a region from the rear end side of the hood panel to a cowl when inflation is completed, and two pillar cover portions extending rearward from both ends of the cowl cover portion, and covering the lower front surface side of right and left front pillars,

the main body portion of the inflator is disposed so that the axial direction substantially extends along a left-right direction, and

when mounted on the vehicle, the guide tether covers a rear side of the inflator to suppress a rearward flow of the inflating gas discharged from the inflator.

3. The pedestrian airbag device according to claim **2**,

wherein the guide tether has a planned breakable portion divided over an entire length by providing an intermittent cut substantially extending along the left-right direction and breaking a peripheral edge site of the cut when the airbag is inflated, and

when the airbag is completely inflated, the planned breakable portion is broken to release a connection state between the pedestrian side wall portion and the vehicle body side wall portion.

4. The pedestrian airbag device according to claim **3**,

wherein the planned breakable portion is disposed near the other end of the guide tether joined to the lid panel.

* * * * *